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AVIATION SAFETY LETTER

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Fuel Tank Selector Reminder

*Learn from the mistakes of others;
you'll not live long enough to make them all yourself...*



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Canada

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Dangerous Goods Carried in Toolboxes

by Roger Lessard, Civil Aviation Safety Inspector, Dangerous Goods Standards, Civil Aviation, Transport Canada

Toolboxes that contain dangerous goods items are not permitted in passengers' carry-on or checked baggage, or in cargo.

Regulations Governing the Transport of Toolboxes Containing Dangerous Goods

The *Transportation of Dangerous Goods Regulations* (TDGR), and by reference, the *International Civil Aviation Organization Technical Instructions for the Safe Transport of Dangerous Goods by Air* (ICAO TIs) regulate the transport by air of toolboxes containing dangerous goods to, from and within Canada.

Any articles or substances contained in the toolbox that are dangerous goods must be removed from the toolbox. These items must be handled, offered for transport, and transported by trained individuals, or under the direct supervision of trained individuals in compliance with the provisions of Part 12, *Air*, of the TDGR.


ICAO TIs

The ICAO TIs set out the provisions to aid the recognition of undeclared dangerous goods, and provide a general description of toolboxes containing dangerous goods:

"tool boxes—may contain explosives (power rivets), compressed gas or aerosols, flammable gases (butane cylinders or torches), flammable adhesives or paints, corrosive liquids, etc."

"Operation Toolbox" Poster

Industry and government convened to develop an "Operation Toolbox" poster to raise awareness among trades people. The poster was designed to highlight examples of items commonly found in toolboxes that cannot be transported by aircraft. The poster artwork is available upon request to any organization.

More information can be found on the following Web site: www.tc.gc.ca/CivilAviation/commerce/DangerousGoods/regoverview/passlugg/Equipment.htm. 

GUEST EDITORIAL

Effective communication with our stakeholders is a key part of our mandate within Regulatory Services. We strive to open the channels of communication through our consultation process, which is enshrined in the Canadian Aviation Regulations Advisory Council's *CARAC Management Charter and Procedures*. At another very important level, effective and safe communication also lies in the use of standardized terminology within our civil aviation system.



Guest Editorial

Considering that terminology standardization is a nationally and internationally recognized safety factor in aviation, the Aviation Terminology Standardization Program was introduced by Transport Canada Civil Aviation in the early 1980s. Its mandate is to ensure the use of standardized terminology in French and English in civil aviation's operational and regulatory documentation, in addition to communications, which have a direct impact on flight safety. The *Glossary for Pilots and Air Traffic Services Personnel*, published in 1994 and updated regularly, serves as a great reference document for the entire Canadian aviation community. In addition, the Civil Aviation Terminology System (CATS), maintained by the Aviation Terminology Standardization Division, is a significant source of information, which provides the definition and translation of the searched expression, as well as other pertinent information, such as a reference to the *Canadian Aviation Regulations* (CARs), if applicable. Both tools are accessible at www.tc.gc.ca/CivilAviation/RegServ/terminology/menu.htm.

The use of standardized terminology is of great importance in communications between all individuals who are involved in the aviation system and is also of great importance when amending the CARs. Inappropriate use of terms can sometimes cause stakeholders to seek complex legal interpretations and possibly cause a misunderstanding of the regulatory requirement, which might then result in gaps in the safety of our aviation system. The abundance of technical terms and the wide variety of acronyms used within civil aviation add to the complexity of an already extensive aviation vocabulary. Hence, we need to be vigilant!

In a fast-paced industry like aviation, good communication skills are a must. We need to strive to communicate effectively, as it is intricately linked to the safety of our aviation system. We hope that this issue of the *Aviation Safety Letter* will enlighten you and that our message is communicated to you successfully!


Franz Reinhardt
Director
Regulatory Services

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Environmental factors

Dear Editor,

Operating out of our normal operating environment can create new challenges, and in many cases can provide us with an opportunity to learn new lessons. This story about flying out of my "normal" environment illustrates this quite well. As an airline-transport-rated pilot with many years of commercial and airline experience, I think I understand the system very well, in particular the IFR environment. While I take great pleasure in operating modern sophisticated aircraft, flying a light aircraft provides me with an opportunity for a different kind of pleasure—to get back to basics by operating in a different environment, mostly VFR and uncontrolled.

One Saturday a few summers ago, I planned a short trip in a floatplane to Red Lake, Ont., from a cottage base in northwestern Ontario. The 80-NM flight was planned for about 45 min. Appropriate charts and the floatplane supplement were reviewed and carried on board. The public AM radio forecast indicated excellent weather for the region. With little convenient ability to get a comprehensive briefing before departure, it was planned to request one once airborne and in VHF range of the Kenora, Ont., flight service station (FSS).

Once airborne, the request was made for VFR to Red Lake, and the FSS confirmed excellent VFR weather en route. After an uneventful flight to the Red Lake area, I tuned and monitored frequency 122.3 (Winnipeg Radio at Red Lake). There was some traffic in the area. One aircraft estimating Howie Bay, Ont. (about 3 NM south of Red Lake), about 10 min ahead of us, another landing at Cochenour, Ont. (about 2 NM west of Red Lake), about the same time, and a CL215 water bomber preparing for departure from Red Lake. We made the standard advisory and provided an estimate for the water base 10 min hence, at about 1505 UTC. The FSS advised of the traffic we had heard, and that the CL215, now airborne, would be performing a demonstration flight of its pick-up and drop capabilities. No other information was provided. The CL215 was in sight from 5–6 NM out, performing what appeared to be a left hand circuit, landing on the water to the west into the favouring wind.

With the CL215 on the frequency and in sight after it had performed a water pick-up, we called overhead and subsequently landed well out in the bay, north of the townsite (approximately 2 mi.). After our landing, the CL215 completed another water run and drop to the south, in front of the townsite. After taxiing into the docks at the north end of town, we were waved into an open spot where we were assisted with docking.

After securing the aircraft, we were approached by a gentleman who informed us he was a Transport Canada (TC) inspector. He inquired as to our departure point and asked if we were aware that there was a NOTAM on Red Lake regarding an air show. We explained that we had departed from a remote area, had received our VFR briefing from the Kenora FSS, and had again communicated on the mandatory frequency (MF) with Winnipeg Radio at Red Lake when arriving in the area. A discussion took place with regard to the responsibility of the pilot-in-command (PIC) for NOTAM awareness. I advised that all reasonable diligence had been performed and needless to say, that I would never knowingly disregard a NOTAM.

We subsequently learned that a NOTAM existed, advising of an air show 1500–1700 UTC, and that non-air show aircraft should stay clear of a 2 NM radius area, 2.5 NM south of Red Lake (approximately the townsite). Given the traffic and advisory, at no time did I feel there was any risk associated with landing in the area. All aircraft were in sight of each other and remained clear.

Later I reviewed what had caused this potential conflict with compliance, risk management and safety awareness, and came up with the following lessons for all to remember:

- when operating out of your normal environment, figure out alternate ways to acquire all the information you need to plan and fly your trip;
- when calling an FSS for a briefing, or when checking in on an MF, specifically ask for all the information you need, including current NOTAMs for the area, rather than expecting that the information will be provided;
- FSS should remind any new aircraft reporting on the MF of any such restrictive NOTAM before and during the NOTAM period;
- other pilots in the area and on the same frequency may want to advise arriving pilots if, by their stated intentions, they seem unaware of the NOTAM;
- while the final responsibility rests with the PIC, the sharing of information by all involved will enhance safety.

I subsequently visited my TC regional office and reviewed this event with an aviation safety inspector. After an open discussion on safety management systems (SMS), we agreed that sharing this story with others could improve awareness and perhaps reduce the risk for others.

Name withheld on request

Are we in trouble to boot?

Dear Editor,

"Alpha Bravo Charlie, Centre would like to talk to you when you get on the ground, are you ready to copy the number?"

Most of us, at some time, have overheard or even received this "request," and generally it's accompanied by knowing looks in the cockpits of anyone on the frequency. Generally, they do not intend to congratulate you on your impeccable flying. So here is the question: Does any crew perform better knowing that ATC has a problem with their flying? I think not. Why, then, are we told this airborne? Shouldn't a request like this be forwarded to whatever tower, flight service station (FSS), etc., that will handle the aircraft once on the ground? There are plenty of ways of contacting a crew after they land, so why the rush to lower the boom?

In a recent example, we were cleared for a circling approach to the opposite runway by Tower after being handed off from Centre. Low fog caused a missed approach, and as we were tracking back to the airport centre in order to accomplish the published missed approach, we were handed back to Centre. Centre wasn't aware that we were re-cleared for a circling approach, so from their point of view, we were going the wrong way, and this led to the dreaded "Centre wants to speak with you..." At this point, we were in the middle of a complicated missed approach, made worse by the fact that we had to accomplish a course reversal once we were over the airport.

In our case, it was just a lack of communication between Tower and Centre, and there was no further trouble, but why didn't Centre call Tower before calling us? Why didn't they leave a message with our operations? Why was

the first choice to add to the stress/workload of an aircraft in the middle of a missed approach? I think this practice needs to be reviewed—consideration should be shown for aircraft and crews that are airborne and hard at work, and these types of messages should be delayed until the aircraft is safely on the ground.

Angus Magrath
Kelowna, B.C.

Transition lenses

Dear Editor,

A pilot friend showed me some new eyeglasses he had made. They are equipped with transition lenses, and have a graduated sunglass feature, as well as a graduated reading glass feature. I need reading glasses to read publications and some instruments in my aircraft, and I find the add-on reading glass lens on my normal sunglasses leave me with a headache and minor vertigo. I bought a set of transition lenses and they are a wonderful improvement. You can wear them night or day and behind a face shield, and the graduated reading glass feature allows you to lower your head or eyes to read instruments or publications with a gradual transition to the reading glass rather than the abrupt change as with add-on bifocals. It saves heads-down time in the aircraft looking for glasses or trying to fit the appropriate pair of glasses under a headset or helmet, and is as close to normal vision as I'll ever get without surgery. You may want to consider writing a short piece in the *Aviation Safety Letter* (ASL) since this may be a fairly significant safety issue given the large number of "older" pilots who have vision challenges.

Bruce MacKinnon
Ottawa, Ont.

Hot Cargo?



This courier flight made an emergency landing in Philadelphia, PA, after the crew detected smoke in the cockpit. The SMOKE/FIRE warning light illuminated three minutes prior to landing, and the crew asked the tower controller to confirm the presence of fire trucks, which the controller did. Upon landing, the airplane was immediately engulfed in fire and the three members of the crew evacuated the airplane via the cockpit window and a door slide. The crew was not injured; however, the airplane was destroyed. The crew did a brilliant, by-the-book job of saving their own lives, while the professional response from ATC and the firefighting units also contributed to their timely and successful egress. Two known pieces of hazardous materials (HAZMAT) were reportedly on board: amyl methyl ketone and tire repair kits. Δ



PRE-FLIGHT

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New Series of Operation Update Seminars Well-Attended by Pilots

by Larry Lachance, Director of Safety Evaluations and Investigations, NAV CANADA

NAV CANADA

The popular Operation Update series of seminars, designed for general aviation pilots flying in and around the Lower Mainland, B.C., was resurrected in the fall of 2005. NAV CANADA considers this an opportune time to resume these seminars, as this airspace continues to be complex, with on-going changes as a result of the *Lower Mainland Aeronautical Study* and the *Vancouver Terminal Reorganization Study*.

When the seminars were first introduced in 1985, Transport Canada was tasked with reducing the number of incursions in Class C airspace in the Lower Mainland of British Columbia. (Class C airspace is controlled airspace within which both IFR and VFR flights are permitted, but VFR flights require a clearance to enter. Air traffic control [ATC] separation is provided to all IFR aircraft, and as necessary to resolve possible conflicts between IFR and VFR aircraft.)

Between 1999 and 2001, NAV CANADA, in collaboration with Transport Canada and the Transportation Safety Board of Canada (TSB), delivered 12 pilot safety seminars for general aviation pilots at flying clubs and schools at various airports in the Lower Mainland and on Vancouver Island. Over 400 pilots with a diverse mix of backgrounds and experience attended the free seminar.

The latest series of Operation Update seminars has been organized by Lana Graham, Regional Safety Manager, Vancouver, and is being conducted by Warren Le Grice, Program Specialist, IFR Training, Vancouver area control centre (ACC). A recipient of both the Chairman's Award for Safety and the Chairman's Award for People, Le Grice has merged his passions for teaching and aviation to deliver the seminars on an array of safety-related topics, spanning over two decades. Response from pilots has been very enthusiastic. Two fall classes and four classes scheduled in the spring promptly filled up, mostly by word of mouth. In all, some 150 pilots will have attended.

The seminars are not meant to instruct pilots on aviator skills, but rather, are a method of highlighting some of the procedures and communication skills required when operating in our complex aviation environment.

As an example, trend analysis shows that altitude deviation, or what pilots more commonly refer to as "altitude busting," is an increasing concern both internationally and in Canadian airspace. Through these seminars, NAV CANADA can share this concern and possible impacts that such occurrences have on our daily activities. At the same time, we can gather additional information to enhance our own understanding of the issues pilots are facing when operating in complex areas.

The Operation Update seminars discuss Canadian and U.S. airspace structure, Lower Mainland airspace and flight procedures, Vancouver and Victoria terminal operations, flying in the VFR terminal area (VTA), how to get the most from our NAV CANADA weather Web site, and the value-added interpretive weather briefing service from flight service specialists at the flight information centre (FIC).

Laminated frequency cards and NAV CANADA aviation weather services guides are handed out. The seminar normally concludes with a tour of the Vancouver ACC provided by a volunteer, such as Rick Korstad, Unit Procedures Specialist. This helps to put a face on our ATC operations.

Judging from the overwhelmingly positive feedback and requests for repeat seminars, our initiative was once again a timely and valued information service. It is intended that through this innovative education program, NAV CANADA will contribute in a meaningful way to promote safety awareness amongst the aviation community in our increasingly busy and complex skies.

Next up: Safety Day

As a follow up to this initiative, our regional safety managers will be conducting a Safety Day with safety officers from industry. There is much valuable safety trend analysis being conducted both within NAV CANADA and by our customers in general aviation. Our purpose with Safety Day will be to provide a platform for the exchange of safety information and for finding solutions that reduce the transfer of risk on both sides. Δ

Ten Questions for the Author of "10 Questions"

If the success of this year's Canadian Aviation Safety Seminar (CASS) can be measured by participation alone, then Halifax was a success! Nearly 400 people attended CASS—a testament to the dedication to safety in civil aviation in Canada, and in Atlantic Canada in particular. All are to be congratulated for their efforts.



Sidney W. A. Dekker

The theme of this year's CASS was "Human and Organizational Factors: Pushing the Boundaries." To set the stage, Sidney W. A. Dekker, Professor of Human Factors at Lund University in Sweden, opened the plenary session with a provocative discussion on the new view of human factors and system safety.

We took some time to speak with Professor Dekker to get his views on a variety of issues related to human factors, and how to advance the cause of safety. Here is what he had to say.

1. *What could North Americans learn from Europeans in managing safety?*

The safety management system (SMS) is about a partnership between the industry and the regulator. Those partnerships, and the lack of an adversarial relationship, are something that by very nature have already existed in Europe. You've already taken the safety management idea from the natural European interaction. It seems to be more accepted in Europe that systemic doesn't necessarily just refer to a static conglomerate of stakeholders, but rather it refers to a completely new way of systems behaving. Systems behave in a certain way that requires a new set of models, a new set of ideas, a new set of indicators to monitor and manage. In Europe, systemic means "a new way in which a system behaves."

2. *Why do we have the same accidents over and over again?*

Are we really having the same accidents? I would say yes, some. So yes, we've seen them before, but now they have been exported to other parts of the world, where regulation is not as strong. When you look at our part of the world, have we really seen these accidents before? When we look at our part of the world we are having accidents where failures, in really safe systems, are preceded not by component failures, but by normal work. Organizations are having accidents by drifting into failure (e.g. Alaska 261), when there are goal conflicts between production and safety resulting from resource scarcity, for example. We should not be surprised to see the leakage from these pressures. The goal is to figure out how to help organizations acknowledge, work on, and resist these pressures.

3. *What is the "new view" of human error?*

The new view of human error sees human error as a consequence, not a cause; it is a start, not a conclusion. The sources of mistakes are structural, not personal. The other part of the definition says that accidents are a structural by-product of people doing normal work; the systems are functioning normally.

4. *The new view sounds fine, but we live in the real world, and when people make mistakes, there are consequences. In this new view, what happens to responsibility?*

Responsibility is an important part of the new view. The new view says you cannot hold someone responsible if they do not have the requisite authority. As soon as you begin discussions about responsibility, you begin discussions about organizations. Responsibility cannot be spoken of in a vacuum.

5. *How would you suggest commercial aviation move from the old view to the new view of human error, given the current safety programs we have [crew resource management (CRM), threat and error management (TEM), line operations and safety audit (LOSA), safety management systems (SMS), etc.]?*

These initiatives, in principle, are not old view. They want to take people's working conditions seriously; they want to take behaviour in context, which is, therefore, a new view. They are very much about understanding the conditions in which people work, and how they create safety. However, the risk in many of these programs is that they seem to see concepts, like error violation, as conceptually non-problematic. In these programs, we count errors and violations, and we use this information to determine how safe an operation is. The assumption that by counting errors and violations, you can measure safety, is problematic, as the real data lies much deeper. What do these errors and violations really mean?

6. *The new view may be fine for big operators, but what could small operators do?*

Small operators could learn to ask the right questions. When they see a human error problem, they could see it as an organizational problem. How does one go about asking a good question? Are you asking why from inside the tunnel (from the operator's perspective, during the sequence of events before the negative outcome occurred)? Are you probing what the operator saw? What the operator heard? These questions work

in reactive situations. What about in the proactive sense? What are good questions to ask? It costs a lot of resources to ask good questions. Another thing small operators could do is freeze old view countermeasures—don't knee jerk, pull licences, punish, write letters, etc. We need to step back and look forward.

7. *What human factors training/education do inspectors/industry need to operate in an SMS world?*

If you want to educate industry, and you want the regulator to collaborate in creating safety first, you need an organizational safety vocabulary so you can talk about the major risks. This may be very contextual. We need to turn people into system thinkers. Some of our models of accident causation are old. We need to shift our thinking and metaphors to understand that a system is something that lives, it can get sick from harmful pressures. We need to teach people how to look for other things—higher variables, such as: are they taking past experience as a measure of future success? *You cannot see the universal but in the particular—but the particulars quickly stop making sense if you have no general concepts to relate them to.* We need to invest in facilitating discussions between generalists and specialists. Technical people need education and updating, as do generalists. This will ensure they are capable of questioning their own assumptions. There should definitely be an opportunity for interactions where specialists and generalists learn from each other.

8. *What qualities do aviation managers need to possess to be more proactive in managing safety?*

Take domain expertise seriously. If you don't, you do so at your own peril. Technical expertise alone does not qualify you to be a manager. You have to learn some skills that apply to running a group of people.

9. *How do you detect and mitigate drift (the slow incremental departure from initial written guidance on how to operate a system)?*

Get in fresh perspectives. Never stop asking questions. Ensure your people have a constant sense of unease. Recognize that that which is acceptable or normal, is not necessarily safe.

10. *What's next after SMS?*

What you have to watch out for is that SMS does not become the nuts and bolts of the 21st century, where all we do is check whether documentation and processes meet specified criteria of quality because safety is an emergent property—it is more than the sum of quality parts. We have to go beyond SMS as a set of separate components, and learn more about how our people can get to see the big picture, because it is in the big picture that big accidents happen—not in the breakdown of any one component. Δ

David Larrigan Wins the Transport Canada Aviation Safety Award

Mr. David Larrigan of British Columbia has received the 2006 Transport Canada Aviation Safety Award for his demonstrated commitment and exceptional dedication to aviation safety over the past 50 years. The award was presented to Mr. Larrigan on April 25 at the 18th annual Canadian Aviation Safety Seminar (CASS) in Halifax, N.S.



David Larrigan (left) receiving his award from Assistant Deputy Minister, Safety and Security, Marc Grégoire

Mr. Larrigan spent 16 years with the Royal Canadian Air Force as a pilot and flight instructor, and retired

with the rank of Colonel. He then spent 21 years with Transport Canada, rising to the position of Director General of Aviation, Pacific Region. He has spent the last 13 years as a consultant to the aviation industry with a primary role as the airside safety officer with the Vancouver International Airport Authority.

He wrote the first Surface Movement Guidance Control System Plan and commissioned the first category (CAT) III runway in Canada. He was instrumental in establishing a foreign object debris management program that has become the template for airports around the world. He is a recognized expert in airport foreign object damage (FOD) control programs around the globe.

At the British Columbia Institute of Technology (BCIT), Mr. Larrigan promoted and guided the development of the first dedicated airport operations diploma program in Canada. He continues to be active in many industry committees, task forces, conferences and meetings promoting aviation safety. He was the recipient of the 2005 British Columbia Aviation Council Lifetime Achievement Award in Aviation. Δ

BLACKFLY AIR ON SMS



Blackfly Air on Training

Blackfly Air is on the move, expanding and hiring—they must be doing something right! A growing aviation business presents new challenges, which can be faced in a structured way with a proper safety management system (SMS) in place. The arrival of new personnel requires training, and your current personnel require recurrent training. That is a fact for all aviation organizations. Here is what the SMS guidance material has to say on that topic.

SMS training

Of course, you need properly-trained personnel to ensure the quality and safety of the operations in your organization. Clear expectations, explicit work instructions, such as maintenance work instructions and standard operating procedures (SOPs) serve two purposes. They let employees know what is expected of them and they allow management to expect consistency in the conduct of operations and to compare what is expected against actual performance. If a deficiency is identified or an event occurs, one of the pieces of the investigation will be to review the quality and the safety of the work instructions or SOPs, and the adequacy of the training provided. Your existing training program will need to incorporate the components related to SMS.

As you develop your SMS, you are adapting it to suit the size, management style and needs of your company. That means that no two systems will look exactly alike. Training, therefore, in how you have chosen to operate, becomes important in helping to ensure that your goals are indeed achieved.

- Existing employees will need detailed briefings on your SMS, your management commitment to it, and their part in making it work.
- New employees will need to be familiarized with how your SMS operates, and in many cases, you will probably find that you have to train them on the basic concepts of SMS as well.
- All employees will need periodic refresher briefings or discussion to make sure that everyone fully remembers what you are trying to do and

how it needs to become, and remain, a part of the organization's lifeblood.

- In flight training operations, although student pilots are not employees, they should be aware of your SMS and be trained in how to report safety deficiencies and hazards in the same manner that they now understand and report aircraft airworthiness problems. If they are commercial pilot students, they will be required to have a basic understanding of SMS principles as part of their licensing requirements.
- In some cases, external stakeholders will need to be aware of your SMS processes so that they can provide you with appropriate documentation and follow-up, when necessary.

Whether you are involved in flight or maintenance operations, to make the SMS work you need to take time to train and, yes, also to document that you did so. You will need to measure whether the person understands the training received, or to what extent existing employees have the understanding you hope they have.

What can you include in any of the above types of training? Here are some examples:

- SMS principles including the continuous improvement loop.
- Details of your company SMS including:
 - Company safety policy
 - SMS policy manual (documentation)
 - Roles and responsibilities
 - Safety reporting system
 - Analysis of accidents/incidents
 - Emergency response plan
 - Special procedures
 - Non-punitive reporting policy
- Emergency equipment review
- Applicable *Canadian Aviation Regulation* (CAR) review

- Operations manual review, including company-specific procedures such as operations specifications for special authorities like low visibility operations.

Pick those that will benefit your specific operation, and then add others that are unique to your type of activity. While many of these training topics are items that require procedural training, remember that in the SMS context, you are focusing on safety-related issues as part of an integrated management plan.

In addition to the obvious benefits gained from training, it is an indication to the employee that management thinks this is important enough to devote dedicated time to it, and it shows to others (customers, insurers, regulators) that you have taken carefully-planned steps to make safety consciousness a fully integrated part of the operation.

Who will provide this training? For some of these topics, you will probably have some staff members who have the expertise necessary to provide the training to others. For other topics, you may have access to outside consulting resources. Feel free to call on your regional Transport Canada office, especially for briefings on SMS principles.

For further information, refer to Chapter 4 of *Safety Management Systems for Small Aviation Operations—A Practical Guide to Implementation* (TP 14135), at www.tc.gc.ca/civilaviation/general/fitrain/SMS/TP14135-1/menu.htm, and *Safety Management Systems for Flight Operations and Aircraft Maintenance Organizations—A Guide to Implementation* (TP 13881). Δ

The Canadian Business Aviation Association Column—Responsibility and Accountability

Canadian Aviation Regulation (CAR) 604 authorizes the Canadian Business Aviation Association (CBAA) to establish business aviation operational safety standards, and issue Private Operator Certificates in accordance with those standards. The CBAA safety standards are performance-based and the certification system is structured on an integrated safety management system (SMS) concept. The CBAA certification system is designed to provide a balance between safety and efficiency.

The traditional certification system relied heavily on Transport Canada's direct oversight for numerous administrative approvals. Although the business aviation industry has an enviable safety record, the traditional system is unsustainable and does not cultivate active operator participation. In order to meet safety performance objectives, proactive operator involvement is a key element identified in both *Flight 2005—A Civil Aviation Framework for Canada* and *Flight 2010—A Strategic Plan for Civil Aviation*. Private operators recognize that proactive risk management is an effective way to improve safety performance. An important factor in making an integrated management system work is the understanding of the relationships within the framework. Companies, flight

departments, regulators, technicians, pilots, dispatchers, inspectors, etc., all have designated functions. Individual responsibilities and accountabilities should be clearly identified

and documented within the SMS framework. An SMS provides effective tools for everyone.

In today's complex and integrated environment, it is not sufficient to be a good technician, pilot, dispatcher or inspector; everyone needs to understand and accept the inherent responsibilities and accountabilities.

The Canadian business aviation community is one of the first groups to implement the Civil Aviation Strategic Plan directives. We are very pleased with the transition that has already occurred. To reach its full potential, the business aviation community will need full participation from all. We are all individually responsible and accountable for aviation safety. Δ



"Keep your eyes on the hook!" Video Now Available!



The new helicopter ground crew safety video that we announced in *Aviation Safety Letter 1/2006*, "Keep your eyes on the hook! Helicopter External Load Operations—Ground Crew Safety" (TP 14334), is now available for purchase, in either VHS or DVD format! While the video is targeted primarily at helicopter ground crews involved in external load operations, it is also applicable for helicopter pilots, operators, and clients who use such heli-services. The video contains several scenarios and testimonials on precarious and challenging slinging operations from all regions in Canada. Order it today from Transact, the online storefront for Transport Canada publications at www.tc.gc.ca/transact/, or by calling Transport Canada's Order Desk at 1 888 830-4911. Δ

COPA Corner—Aircraft Type Clubs Can Reduce Your Risks

by Adam Hunt, Canadian Owners and Pilots Association (COPA)



One of the sciences that studies groups and how they work is social psychology. Research in this area tells us much about the value of being part of a group for the individual members. Some of the general benefits include: meeting the need to belong, providing information to members of the group, providing rewards and achieving collective goals.

One of the most useful groups that a pilot and aircraft owner can belong to is an "aircraft type club." These clubs cater to the owners and pilots of one specific aircraft type or a series of types. Because of this focus on a single aircraft type and its variants, these clubs can provide a lot of detailed information on aircraft maintenance considerations and type-specific aircraft piloting skills. Belonging to a type club can give you the information you need to reduce your risks in owning and flying your individual aircraft—now that is worthwhile!



Type clubs organize fly-ins where you not only mingle with other pilots, but experience the thrill of parking your aircraft next to its long-lost siblings. The fly-in above was a successful meeting of Challenger ultralight owners and pilots at Château Montebello, Que., in January 2005. Photo: A. Hunt

Aircraft type clubs are common—there are literally hundreds of these clubs around the world providing services to many, if not most, aircraft types that have been produced in any significant numbers. There are type clubs for certified aircraft, warbirds, sailplanes, amateur-built and ultralights.

Type clubs vary a lot in the services they offer and how they work. Some are simply volunteer clubs run by one enthusiast, using a free Web service to provide a Web site. These often have minimal publications or services. On the other end of the scale, some of the largest types clubs have a full-time staff and offer a wide range of services.

Here are services that some type clubs offer:

- A magazine to pass on type-related information, news and events;
- A Web site, often with type-specific buyer's checklists;
- Technical question support from aircraft type experts;
- Buyer's guides;
- Conventions and fly-ins;
- Information on applicable Airworthiness Directives, Service Bulletins and Service Letters;
- Information on available Supplemental Type Certificates;
- Type-specific classified ads (often online);
- Background and aircraft type historical information;
- Maintenance tips publications;
- Operating tips information;
- Maintenance and aircraft systems courses;
- Aircraft type conversion training programs;
- Type-specific insurance (often available in the U.S. only!);
- Formation flying training;
- Scholarships;
- Many other possible services.

In some cases, with highly popular aircraft designs, there are competing type clubs that all offer services for the same aircraft type or types. In those cases, the owner has a choice of clubs, or they can just join them all!

COPA supports aircraft type clubs—they serve a great need in the aviation world, providing type-specific technical information and support that is not provided by anyone else. Consider joining and supporting the club for the type of aircraft that you own or fly—most of them are well worthwhile.

COPA has listed all the aircraft type clubs that we are aware of on the COPA Web site. We welcome submissions of clubs that we don't know about yet.

What if you check and discover that there is no type club for your aircraft type? Well then, consider starting one. With free Web services on which to post a Web site, it can be done at no cost. If nothing else, you will meet many more fans of the aircraft type you own and learn a lot about your individual aircraft along the way! In the next COPA Corner, I will address the benefits for pilots who do not own an aircraft to be members of a traditional flying club.

The COPA Web site is www.copanational.org. 

Inadvertent Transponder Code 7500

by Randy Todd, Civil Aviation Safety Inspector, Prairie & Northern Region, Transport Canada

The pilots involved were a flight instructor and a commercial student pilot. The aircraft was a single engine trainer. A code of 7500 had been inadvertently left on the transponder, which had gone unnoticed by this crew in their walk-around. The training flight departed on a three airport, round robin cross-country trip encompassing about 250 mi. Several minutes after takeoff, the flight entered a radar coverage area causing a warning alarm at the area control centre (ACC). In an attempt to contact the aircraft in order to ensure things were all right, the ACC asked the flight service station (FSS) to relay a message on the en-route frequency. Unfortunately, the radio strength and readability between FSS and the aircraft was poor.

The pilot believed FSS had requested that he select code 7500 for flight following. He believed he was complying with a legitimate request, so he read back the code and confirmed it was entered in "the box." FSS had actually asked the pilot to confirm he was squawking 7500, and could query the pilot no further so as not to upset a potentially dangerous situation. Confirmation of the code 7500 is confirmation of a hijack. Communication with the aircraft was lost; however, the aircraft was still within radar coverage. The miscommunication was further compounded since air traffic services (ATS) were then required to execute the hijack procedure, and as a result, the RCMP responded with emergency security measures. A Canadian Military DHC8 in the area did attempt to contact the aircraft, but was unsuccessful.

The flight plan was reviewed by ATS, and the RCMP dispatched personnel to the first airport on the flight plan, an airport with a mandatory frequency (MF), to intercept the flight upon landing. The student pilot successfully executed a touch-and-go and was then off to airport two, unaware of the security measures in position on the apron.

The authorities had interpreted this as the pilot, upon seeing the cruiser, making a getaway. This development was relayed to the shift supervisor at ATS, who advised the RCMP to advance to the next airport on the flight plan, again an aerodrome traffic frequency (ATF) airport, again a touch-and-go. Same result.

Approximately an hour and a half into the flight, and as the aircraft was arriving at the third airport on the flight plan, FSS was able to make radio contact again. Again, the FSS asked the pilot to confirm he was squawking a transponder code of 7500. The pilot again positively confirmed code 7500. All efforts were made by FSS to avoid provoking the escalation of a serious situation in the cockpit, as this was being treated as a real hijack.

As the aircraft approached the airport, the RCMP was again awaiting the arrival of the aircraft. This time the plane did land. As the pilot entered the ramp, the police cruisers intercepted the progress of the aircraft and apprehended the unfortunate pilots. After several hours of interrogation, the pilots were free to return to their aircraft.

The event occurred as a result of a lack of a thorough cockpit safety check and not questioning an unusual request from an air traffic controller. These are both symptoms of complacency in the cockpit. There was no evidence of a regulatory infraction of *Canadian Aviation Regulation* (CAR) 602.01. The possibility that this aircraft was operated in a reckless or negligent manner as to endanger, or be likely to endanger, the life or property of any person, does not apply since the pilot believed he was complying with a legitimate ATS request. However, there was a great deal of labour and expense engaged in this undertaking, as ATS and the RCMP had to treat the event as an actual hijacking. Δ

Your PIREP could save My life!

SARSCENE 2006

The fifteenth annual search and rescue (SAR) workshop will be held in Gatineau, Que., October 4-7, 2006. The theme for SARSCENE 2006 is "SAR: Strength in community." It includes four days of presentations, demonstrations, a tradeshow, SAR games, training sessions and an awards banquet. Co-hosted by the National Search and Rescue Secretariat and the *Sûreté du Québec*, in association with the *Association Québécoise des Bénévoles en Recherche et Sauvetage*, SARSCENE 2006 kicks off on October 4 with the tenth annual SARSCENE games. The workshop is a unique opportunity for SAR personnel to share their expertise and ideas, with over 600 participants from air, ground and marine organizations across Canada, and around the world. Take time to see the Outaouais and National Capital Region! Don't miss the early registration discount deadline of August 31, 2006. For more information contact the Secretariat at 1 800 727-9414, e-mail SARSCENE2006@nss.gc.ca, or visit www.nss.gc.ca. Δ



RECENTLY RELEASED TSB REPORTS

The following summaries are extracted from Final Reports issued by the Transportation Safety Board of Canada (TSB). They have been de-identified and include only the TSB's synopsis and selected findings. For more information, contact the TSB or visit their Web site at www.tsb.gc.ca. —Ed.

TSB Final Report A04Q0026— Separation of Main Rotor on Run-up

On March 8, 2004, a Schweizer 269C-1 helicopter with one pilot on board, was undergoing ground tests following a 100-hr inspection and replacement of the main transmission gearbox. After the second test to check for leaks and to measure tail rotor vibration, engine rpm was reduced. At this time, the pilot and ground engineer heard a noise. The noise was heard again on the third test. Engine rpm was reduced, but this time the main transmission gearbox stopped turning suddenly and caused the main rotor to separate from its shaft. The main rotor rose to an altitude of approximately 150 ft above ground level (AGL) and came to rest on the apron of the heliport, about 100 ft from the helicopter. The helicopter remained in place and there were no injuries. The accident occurred at 11:45 Eastern Standard Time (EST).



Findings as to causes and contributing factors

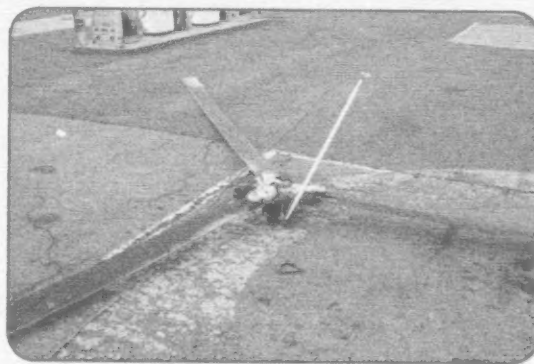
1. The input quill bearing housing was not positioned in accordance with the procedures described by the manufacturer; therefore, the flow of oil was obstructed, causing the catastrophic failure of the input quill bearings.
2. Independent inspection did not detect the incorrect reassembly of the main transmission gearbox.

Other findings

1. There are no mechanical means to prevent an installation error when installing the input quill bearing housing.
2. The force required to shear the main rotor shaft is higher than the force required to shear the six rotor head attachment bolts. As a result, the rotor could separate from the shaft in the event of a sudden stoppage of the transmission, which constitutes a hazard for helicopter occupants and people on the ground.

Safety action taken

At the completion of the main transmission overhauls, at sudden stoppage inspections, or in any other situations in which the retainer has to be removed, the overhaul company will paint a red witness line on the retainer and on the transmission housing to assure alignment of oil ports. Also, they will run the transmission for 15 min to check that there is oil flow in the transmission, and to check for oil leaks at the seal and split line. These changes will be put into their worksheets.



Main rotor lays on the ground, after it separated from the aircraft

TSB Final Report A04Q0049— Runway Excursion

On April 19, 2004, a Beechcraft A100 was on a chartered IFR flight from Québec/Jean Lesage International Airport, Que., to Chibougamau/Chapais Airport, Que., with two pilots and three passengers on board. The co-pilot was at the controls and was flying a non-precision approach for Runway 05. The pilot-in-command took the controls less than 1 mi. from the runway threshold and saw the runway when they were over the threshold. At approximately 10:18 Eastern Daylight Time (EDT), the wheels touched down approximately 1 500 ft from the end of Runway 05. The pilot-in-command realized that the remaining landing distance was insufficient. He told the co-pilot to retract the flaps, and applied full power, but did not reveal his intentions. The co-pilot cut power, deployed the thrust reversers, and applied full braking. The aircraft continued rolling through the runway end, sank into the gravel and snow, and stopped abruptly about 500 ft past the runway end. The aircraft was severely damaged. None of the occupants was injured.



Findings as to causes and contributing factors

1. The aircraft was positioned over the runway threshold at an altitude that did not allow a landing at the beginning of the runway, and this, combined with a tailwind component and the wet runway surface, resulted in a runway excursion.
2. Failure to follow standard operating procedures (SOP) and a lack of crew coordination contributed to confusion on landing, which prevented the crew from aborting the landing and executing a missed approach.
3. The pilot-in-command held several management positions within the company and controlled the pilot hiring and dismissal policies. This situation, combined with the level of experience of the co-pilot compared with that of the pilot-in-command, had an impact on crew cohesiveness.

Findings as to risk

1. The pilot-in-command decided to execute an approach for Runway 05 without first ensuring that there would be no possible risk of collision with the other aircraft (*another Beechcraft 100, inbound from the west*).
2. The regulatory requirement to conform to or avoid the traffic pattern formed by other aircraft is not explicit as to how the traffic pattern should be avoided in terms of either altitude or distance, which can result in risks of collision.
3. The regulations do not indicate whether the missed approach segment should be considered part of the traffic pattern; this situation can lead pilots operating in uncontrolled airspace to believe that they are avoiding another aircraft executing an instrument approach, when in reality a risk of collision exists.

TSB Final Report A04O0103—Aircraft Stall During Instrument Approach

On April 22, 2004, a Raytheon B300 (Super King Air) aircraft was on a repositioning flight from Earlton, Ont., to Timmins, Ont., with only the flight crew and an

engineer on board. At approximately 06:50 EDT, the flight crew was conducting an instrument landing system (ILS) approach to Runway 03 at Timmins. The autopilot was on, and had been in use for the entire flight.

The aircraft was in instrument meteorological conditions (IMC) and icing conditions were encountered. The de-icing boots were being cycled and other anti-icing equipment had been selected ON. The aircraft was in level flight at 2 700 ft above sea level (ASL) in the vicinity of the final approach fix (FAF), with the landing gear down and flaps selected to the approach setting. The aircraft was above the glide slope and the airspeed was approximately 100 knots indicated airspeed (KIAS). The normal approach speed is approximately 125 KIAS. The pilot flying (PF) began to take corrective action just as the aircraft stalled. The PF initiated a stall recovery by applying maximum power and lowering the aircraft's nose. Approximately 850 ft was lost during the stall, and the aircraft reached a minimum height of approximately 800 ft AGL. Once the aircraft recovered from the stall, the crew flew a missed approach. The crew conducted another ILS approach at an approach airspeed of approximately 140 KIAS and landed without further incident. After landing, the flight crew noted 1 to 1½ in. of ice on the aircraft's winglets and static wicks, and some ice on the engine nacelles and fuselage.

Findings as to causes and contributing factors

1. During the approach, the flight crew did not monitor the airspeed, and it decreased until the aircraft stalled.
2. The aircraft stalled at a higher-than-normal airspeed for the configuration because it had accumulated ice on critical flying surfaces during the approach.
3. The aircraft stall warning system did not activate because it was not designed to account for the aerodynamic degradation from the ice accumulation, or to adjust its warning to compensate for the reduced stall angle of attack caused by the ice.
4. During the approach, the autopilot was not changed from the altitude-hold mode to the approach mode; therefore, the aircraft did not intercept the glide slope. As a result, when the PF decreased the engine power in anticipation of glide slope interception, the aircraft decelerated in level flight.
5. Because the aircraft was on autopilot, the flight crew members did not notice any indications of impending stall, nor did they notice any signs of decreasing airspeed, such as increasing nose-up attitude, trim changes, increasing angle of attack, and less responsive controls.
6. The flight crew did not consider that the 140-kt minimum airspeed in sustained icing conditions applied to all phases of flight, including the approach.

The crew, therefore, planned to fly the approach at a normal approach airspeed of 125 KIAS.

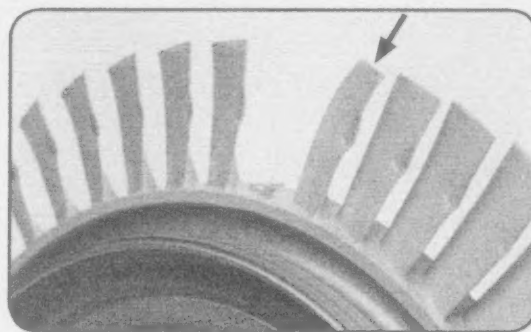
7. Because the flight crew members did not characterize the icing conditions as severe, they did not follow the precautions specified in the aircraft flight manual (AFM) for flight in severe icing conditions, such as requesting priority handling from ATC to exit the icing conditions, or disengaging the autopilot.
8. The flight crew did not practise effective crew resource management (CRM) during the approach: there was no discussion of appropriate procedures for conducting the approach in icing conditions, and critical flight parameters were not effectively monitored by either crew member.

Findings as to risk

1. Other than the CRM training both flight crew members received during their aircraft-type training at Flight Safety International (FSI), neither pilot had any recent, formal CRM training. Since the flight was conducted under *Canadian Aviation Regulation (CAR) 604*, specific CRM training was not required, nor is it required for CAR 704 operations.
2. The first officer, who was the pilot not flying (PNF), had no specific training in the role and duties of the PNF during his initial type training at FSI, and there is no regulatory requirement to receive this type of training.
3. Typically, flight crews receive only limited training in stall recognition and recovery, where recovery is initiated at the first indication of a stall. Such training does not allow pilots to become familiar with natural stall symptoms, such as buffet, or allow for practise in recovering from a full aerodynamic stall.
4. Typically, the training of flight crews for flight in icing conditions is limited to familiarization with anti-icing and de-icing equipment and simulator training, while the opportunity to train for flight in actual icing conditions is limited.
5. Inappropriate guidance on pneumatic de-ice boot operating procedures can lead to de-ice boots being used in a less-than-optimal manner.
6. Inconsistent guidance on autopilot use in icing conditions can lead to its use in conditions where hand flying would provide an increased opportunity to recognize an imminent stall.
7. Typically, aircraft such as the Raytheon B300 are not equipped with a low airspeed alerting system.

TSB Final Report A04P0142— In-flight Power Loss

On April 28, 2004, a Bell 206L helicopter was in cruise flight at an altitude of about 700 ft ASL when the pilot heard a sudden unusual noise, and subsequently experienced an engine power loss. He lowered the collective and checked the instruments while scanning the area for a landing spot. The engine was still running; however, the turbine outlet temperature was climbing very rapidly and quickly exceeded the range of the gauge. The pilot subsequently raised the collective slowly, but the main rotor started to droop. He advised the two passengers of an engine failure and entered auto-rotation. While initiating a flared landing, he pulled the collective and confirmed no power from the engine as the low rotor horn sounded. The helicopter landed on a logging road near Tasu Creek, Queen Charlotte Islands, B.C., in the Sandspit area at 08:29 Pacific Daylight Time (PDT). The pilot shut down the engine immediately on landing. There were no injuries or airframe damage.



Arrow pointing to blade failure caused by thermally-induced fatigue cracking

Finding as to causes and contributing factors

1. Thermally-induced fatigue cracking initiated radially inward in a low-cycle mode in the blade platform fillet area, then progressed normal to the blade axis in a high-cycle mode, eventually resulting in a blade failure due to overstress rupture when the remaining area could no longer support the applied loads.

Findings as to risk

1. Hot starting events and/or power transients are not recorded in this type of helicopter and may not be recorded accurately by an operator even if detected. Turbine wheel failures may occur when hot starts and power transients are undetected, or if their effects go unchecked.
2. The first-stage turbine wheel revealed many type A, and approximately four type B, cracks in the blade rim, and cracks in the fillet radius of blades can lead to turbine failures. There is no prescribed scheduled inspection to detect these cracks, but a turbine special inspection is

recommended when turbine outlet temperature limits are exceeded. No cracks in the blades are allowed.

Other finding

1. Approximately 25 percent of the major diameter seal was missing from the rear support as a result of disbonding due to a bond failure that likely resulted in a slight loss of engine efficiency.

TSB Final Report A04A0148— Collision with Terrain

On December 5, 2004, a Piper PA-28-140 with an instructor-pilot and student on board, departed St. John's International Airport, N.L., at 13:38 Newfoundland Standard Time (NST) for a local instructional flight. The aircraft climbed on a southwesterly heading to 2 000 ft ASL. At 13:43, the pilot reported leaving the control zone, which was the last radio communication from the aircraft.

ATC radar data showed that the aircraft then descended gradually while executing a series of 90° turns. The aircraft's ground speed during the descent was between 50 and 70 kt (all radar speeds are ± 5 kt). After the fourth turn, the aircraft's ground speed increased to 100 kt. The aircraft then disappeared from radar at about 600 ft ASL (200 ft AGL), reappearing 37 seconds later at 700 ft ASL (about 250 ft AGL) (all radar altitudes are ± 50 ft). The aircraft entered a tight left turn then disappeared finally from radar at 13:52:10, while on a westerly heading at 70 kt ground speed. The position of the last radar return coincided with the location of the accident site. The student pilot died in the crash. The instructor received serious injuries, including head injuries with post-trauma amnesia, and was not able to provide investigators with information relating to the accident. Shortly after the accident, occupants of a passing vehicle noticed the aircraft wreckage and called 9-1-1 at 13:59:51. There were no known witnesses to the accident.



*TSB aircraft accident investigator
Allan Chaulk examines the wreckage*

Findings as to causes and contributing factors

1. The aircraft was flying in conditions conducive to serious carburetor icing at any engine power setting. It is likely that carburetor ice formed and restricted the engine power available to the point where the aircraft would not maintain level flight.

2. The aircraft subsequently struck the ground, perhaps as the result of a stall.

TSB Final Report A04Q0199— Runway Excursion

On December 24, 2004, a Beech King Air BE-A100 departed Puvirnituq, Que., under IFR for a scheduled flight to Kuujuaq, Que. There were two crew members, four passengers, and cargo on board. Strong crosswinds and slippery runway surface conditions had been reported by the Kuujuaq flight service station (FSS) personnel. The crew conducted an ILS approach to Runway 07 in IMC and touched down at 19:43 EST. Immediately after landing, the aircraft started skidding to the right and departed the landing surface, coming to a rest 1 600 ft from the threshold, and 40 ft to the right of the runway. The aircraft was substantially damaged, but none of the crew or passengers was injured.



Findings as to causes and contributing factors

1. The crew did not assimilate the information regarding wind and runway conditions, and continued an approach for which there was no viable landing option.
2. The first officer did not anticipate a landing on Runway 07, which did not allow the crew to properly discuss the risk of landing on a slippery runway in strong crosswind conditions.
3. The flight crew did not make use of crosswind charts during flight planning or when preparing to land at Kuujuaq.
4. Company SOPs do not provide specific guidance with respect to maximum crosswind or minimum Canadian Runway Friction Index (CRFI) values.

Other finding

1. It is possible that the crew may have felt some degree of self-induced pressure to land at Kuujuaq, given that it was Christmas Eve, and that cargo consisted mainly of company Christmas presents.

Safety action taken

The operator has released a crosswind limits SOP bulletin that indicates a crosswind limit for the aircraft, and

emphasizes the need to make reference to the prevailing runway surface conditions for both the planning and in-flight phases of the flight.

TSB Final Report A05P0038— Dual Engine Power Loss and Hard Landing

On February 24, 2005, the pilot of a Bell 212 helicopter was carrying out heli-skiing operations in the Blue River area of British Columbia. After taking off from the top of a glacier, at about 8 000 ft ASL, the pilot made a downwind approach to land at a pick-up area at the toe of another glacier. When the helicopter was at about 150 ft AGL, and at about 30 kt air speed, the pilot increased the collective pitch to slow his rate of descent, but the engines (Pratt & Whitney Canada PT6T-3DF) did not respond. The low rotor rpm warning sounded and the rotor rpm decreased. The pilot lowered the collective and confirmed that the rpm beep was full up and the engine throttles were fully open.

The pilot flew the helicopter toward a snow-covered, frozen lake. The sink rate could not be arrested as the rotor rpm had not recovered, and the helicopter landed hard, yawed right about 90° and remained upright. The deep snow absorbed some of the impact forces, but the helicopter was substantially damaged. After the landing, the rotor rpm appeared to start accelerating and the pilot shut the engines down immediately. The pilot, the only person on board, was not injured.

Findings as to causes and contributing factors

1. The installation of a non-standard torque control unit (TCU) required that the engine Nf governors be rigged abnormally. The non-approved rigging amplified the effect of normal-type wear in the governors; the governors did not function properly, resulting in inadequate power from both engines upon pilot demand.
2. Rpm and torque oscillations probably aggravated the opposing engine rpm governors' weaknesses due to wear, and caused malfunctions at the same time.
3. The loss of power in both engines occurred at a critical time of flight, resulting in a hard landing.

Finding as to risk

1. In-service wear causes the governors to malfunction before reaching their overhaul life of 4 500 hr; the average time in service before they are removed for repair is about 1 600 hr.

TSB Final Report A05P0262— Helicopter Roll-over—Glassy Water

On October 26, 2005, a Bell 206B helicopter, equipped with fixed float landing gear, was carrying out lake water

sampling operations for Environment Canada. It departed Chilliwack, B.C., with one pilot and two Environment Canada employees on board. Their mission involved landing on lakes north of the Vancouver Lower Mainland area to collect water samples. Following landings on eight different lakes, where the winds were light and variable, they attempted to land on Devils Lake, where the wind was calm. The water was quite glassy and was shaded from the sun by hills. The pilot made a shallow approach from the south to the middle of the lake, with reference to the shoreline 200 to 400 m away and some small ripples on the water. Before the pilot anticipated touching down, the helicopter struck the surface of the lake and flipped onto its back. It remained afloat supported by the floats, but the cabin was submerged. The passenger from the back seat and the pilot were able to exit the wreckage, but the passenger seated in the left front seat was unconscious. The passenger who had escaped the wreckage rescued the front-seat passenger but she died about six days later from injuries received in the accident. The helicopter sustained substantial damage. The accident occurred at about 13:00 PDT.



Findings as to causes and contributing factors

1. Glassy water conditions impaired the pilot's ability to judge his height above the lake, and during the landing, the helicopter's floats contacted the water before the pilot expected them to, dug in, and the helicopter flipped over.
2. One of the helicopter's main-rotor blades broke on contact with the water and penetrated the front of the helicopter. Wreckage debris struck the pilot and the front-seat passenger on their heads.

Other findings

1. The pilot was wearing a helmet, which protected him from serious head injuries.
2. Recent underwater emergency escape training contributed to one passenger's ability to safely escape from the helicopter and rescue the other passenger from the submerged wreckage.
3. A satellite telephone was available; this contributed to prompt accident scene response. Δ

ACCIDENT SYNOPSES

Note: All aviation accidents are investigated by the Transportation Safety Board of Canada (TSB). Each occurrence is assigned a level, from 1 to 5, which indicates the depth of investigation. Class 5 investigations consist of data collection pertaining to occurrences that do not meet the criteria of classes 1 through 4, and will be recorded for possible safety analysis, statistical reporting, or archival purposes. The narratives below, which occurred between November 2005 and January 2006, are all "Class 5," and are unlikely to be followed by a TSB Final Report.

—On November 9, 2005, a Bell 206B helicopter was transporting two passengers from Island Lake, Ont., to a fishing camp situated 50 NM east of Island Lake, on East Lake, Ont. Upon touching down on a log-constructed landing pad, the pilot applied collective to reposition the helicopter on the pad. The right bear paw on the high-skid landing gear caught a root or stump near the pad, and the helicopter rolled over onto its right side. The pilot and passengers were wearing shoulder restraints, which minimized their injuries; one passenger received a minor cut to the head. The pilot used an on-board satellite phone to call for assistance. *TSB File A05C0204.*



Artist's impression of the rollover as it happened

—On November 12, 2005, a RAF 2000 GTX-SE-F1 gyroplane had just taken off from the Saint-Hyacinthe, Que., airport when it was seen conducting a right turn with a longitudinal oscillating movement. The main rotor struck the tail and the aircraft crashed. The aircraft was destroyed on impact, and in the fire that ensued. The pilot, the only one on board, was fatally injured. This was the first flight since the aircraft had undergone major repairs following an accident that occurred on September 5, 2005. *TSB File A05Q0212.*

—On November 12, 2005, the pilot of an R22 was practising lateral movements near the ground, when the right skid struck the sloping ground. The aircraft rolled onto its right side before coming to a stop. The pilot, who was the only person on board, was not injured. The aircraft was substantially damaged. *TSB File A05Q0217.*

—On November 14, 2005, an Aerospatiale AS350BA helicopter was manoeuvring at about 100 ft above tree tops prior to entering a confined area, when the main rotor rpm reportedly entered an overspeed condition of more than 450 rpm. The collective was raised in an unsuccessful attempt to slow the rotor rpm, and then the throttle was removed from the flight detent. The engine suddenly lost power and the low rotor rpm horn sounded. The helicopter settled into the trees and came to rest on its right side, and was substantially damaged. The pilot and two of the passengers were uninjured; the third passenger received minor injuries. Assistance was summoned by satellite phone. *TSB File A05W0232.*

—On December 11, 2005, a Piper PA-12X (Super Cruiser) on skis was returning from a local flight. The pilot, alone on board, had to change the landing area because there were snowmobiles on the lake. After landing, the pilot taxied on the frozen surface of the lake to return to his home. At one point, he noticed that the ice was about to break under the weight of the aircraft. He stopped and had enough time to exit the aircraft before it broke through the ice and sank up to its wings. *TSB File A05Q0227.*

—On December 19, 2005, a Bell 206B helicopter was on a railway support operations flight. While descending to land beside the railroad tracks, a main rotor blade struck a telephone wire strung alongside the tracks. The pilot did not see the wire due to reduced visibility in semi-whiteout conditions while approaching the ground to land. There were no injuries to the occupants on board. The main rotor blades and drive train required maintenance action. *TSB File A05Q0228.*

—On December 21, 2005, the pilot of a Cessna C180J floatplane had dropped-off two passengers and was taxiing away in Stewardson Inlet, B.C. With the engine set at 1 000 rpm, the aircraft was overturned by a severe port-side quartering tailwind gust. The winds in the area were reportedly at 23 kt, gusting to 27 kt. The aircraft remained afloat and the pilot climbed onto a float, then paddled the aircraft to the shoreline where he secured it to a tree; he was later rescued by boat. *TSB File A05P0301.*

—On December 22, 2005, a Beech King Air B200 was departing from Runway 25 at the Valley View, Alta., airport, approximately one hour before sunrise. During the final stages of the take-off roll, the pilot-flying noticed a large brown object off to one side, followed by a thud. The flight crew rejected the takeoff and the aircraft was brought to a stop with 20 ft of runway remaining. The remains of a medium-sized deer were found on the runway. Damage from the impact required repairs to the left main gear doors and left propeller, and the removal of the left engine for a hot section overhaul. Transport Canada Aerodrome Safety subsequently reported that the Valley View airport is a registered aerodrome rather than a certified site; therefore, it is not required to have a bird and wildlife program. This deer strike was the first time an event such as this has ever occurred since the inception of the airport there. The town does provide runway condition reports to incoming charter flights, and maintains the runway and apron lighting as well as their surfaces. *TSB File A05W0250.*

—On December 27, 2005, a Hughes 500D helicopter had been engaged in logging operations near Powell River, B.C. The pilot landed to refuel the helicopter after finishing work in the second area. After shutting down the engine, the pilot removed his helmet, exited the helicopter and walked to the fuel truck. Upon standing up on the fuel truck, the pilot was struck in the head by the outboard foot of the still-turning main rotor blades. The pilot was medivaced to hospital. *TSB File A05P0304.*

—On December 30, 2005, a King Air B100 was inbound to La Ronge, Sask., from Pinehouse Lake, Sask., on a MEDEVAC flight. On descent into La Ronge, the crew noticed ice building in the wing leading edges. At approximately 6 NM back on final, the crew operated the wing de-ice boots; however, a substantial amount of residual ice remained after application of the boots. It was reported that in the landing flare, at about 100 kt, the aircraft experienced an ice-induced stall from an altitude of about 20 ft, followed by a hard landing. The right wing and nacelle buckled forward and downward from the landing impact forces, to the extent that the right propeller struck the runway surface while the aircraft was taxiing off the runway. *TSB File A05C0225.*

—On January 11, 2006, a Beech A100 was on a MEDEVAC flight from Red Lake, Ont., to Dryden, Ont., and it experienced a hard landing on Runway 11 at Dryden. The aircraft was able to taxi to the ramp; however, post-flight examination revealed skin buckling on the fuselage, which will likely require major repair. There were no injuries to the crew or two paramedics on board. The crew had experienced ice

on approach, but believed the ice was shed normally. Information provided indicated that a small amount of ice and residual ice was observed on the aircraft after the landing. *TSB File A06C0005.*

—On January 11, 2006, a Piper PA-31 was landing on Runway 30 at Wetaskiwin, Alta. (CEX3), after an IFR flight from Vermilion, Alta. During the landing, the crew lost sight of the runway in a thin layer of dense fog that covered the airport. They aborted the landing, and the aircraft settled into a field about ½ mi. northwest of the airport. The pilots sustained serious injuries and the aircraft was substantially damaged. The flight crew used a cell phone to call for help. The emergency locator transmitter (ELT) activated during impact. *TSB File A06W0010.*

—On January 14, 2006, a private Cessna 172M was landing on an unregistered grass strip at Linden, Alta., as part of a group of aircraft on a "fly-in." It floated most of the way down the 3 000-ft strip before touching down about 1 000 ft from the end. The pilot was unable to stop with maximum braking, and the aircraft drifted off the right side, colliding with an unoccupied Sylvaire Bushmaster II ultralight in the parking area. Both aircraft ended up on a road off the end of the strip and sustained substantial damage. The ELT on the Cessna was activated automatically. The two occupants of the Cessna were wearing shoulder harnesses and were uninjured. Between ¼ to ½ in. of loose snow covered the strip, and the Cessna 172 landed with a light tailwind. By the time the pilot determined that he would not be able to stop in the remaining distance, an aborted landing was not possible due to a 40-ft power line across the departure end of the runway. *TSB File A06W0015.*

—On January 15, 2006, after conducting a first solo flight, a student-pilot taxied a Cessna 150 to the tie-down area. While taxiing, the aircraft's left wing struck a hangar and creased the wing skin. Maintenance is sending the left wing out to be reskinned. *TSB File A06O0010.*

—On January 18, 2006, a PA-31-350 was conducting a flight between Puvirnituq, Que., and Inukjuak, Que., with one pilot and one passenger on board. While on short final for Runway 07, at approximately 100 ft AGL, the aircraft suddenly lost altitude due to strong winds, and touched the ground approximately 200 ft before the runway threshold. The landing gear broke, and the aircraft came to a stop on the runway. The aircraft was substantially damaged. Nobody was injured. According to the METAR for 1700Z, which was a few minutes before the accident occurred, the winds were 100° at 16 kt, gusting up to 24 kt, the visibility was ½ mi. in light snow with snowdrifts, and the vertical visibility was 1 000 ft. *TSB File A06Q0004. Δ*



The International Runway Friction Index (IRFI)—Ready for the Real World?

by Angelo Boccanfuso, Senior Development Officer (R&D), Transportation Development Centre, Transport Canada

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The development of an IRFI is a testament to international cooperation within the aviation industry. With most technical milestones passed, Angelo Boccanfuso reports from the latest International Meeting on Aircraft Performance on Contaminated Runways (IMAPCR) that further consensus on practical implementation and funding are now needed...

Not only is there no common indicator of contaminated runway conditions in use worldwide, but winter procedures vary from airport to airport, and from country to country. After winter testing spanning a period of eight years, the Joint Winter Runway Friction Measurement Program (JWRFMP), a cooperative international initiative coordinated by Transport Canada, has reached a major turning point in the decades-old search for a way to measure runway friction and present the data to pilots in a useful way.

IMAPCR 2004

This article presents the results of the third IMAPCR, held in Montreal in November 2004. What emerged from this meeting, which is held every four years, was general agreement that the science behind the concept of an IRFI is workable. However, further work may be needed to turn the results of the research into a practical and useful tool for all of the stakeholders.

Organized by Transport Canada, in partnership with the National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA), and held at the International Civil Aviation Organization (ICAO) headquarters, IMAPCR drew a wide variety of participants with a professional interest in aircraft operations in severe winter conditions, and focussed on the JWRFMP's findings. JWRFMP has assembled a database with the results of over 10 000 ground runs with more than 12 different types of friction testers and 8 different aircraft. It has produced what it believes are the necessary building blocks for an IRFI.

That success is a tribute to the extraordinary level of international cooperation that assembled a group of professionals and organizations—pooling facilities and resources to enable a major research program at a relatively low cost.

At the moment, airport operators and pilots rely on a system that lacks a common standard and utilizes varying

devices and differing terminology. The JWRFMP has greatly improved the safety of the system simply through disseminating information and increasing operator awareness. The meeting heard repeated calls for an international measuring and reporting system. It is not enough for each country to adopt its own measuring and reporting system and assume the job has been completed.

Working with an index

For an IRFI to work though, it requires, first of all, a common reference for the various ground vehicles used at various airports—an international reference vehicle (IRV). The IRV used in the research program was a French-designed *instrument de mesure automatique de glissance* (IMAG). Friction values of other devices were harmonized with those of the reference vehicle through linear regressions.



IRV used in the research program was this French-designed *instrument de mesure automatique de glissance* (IMAG)

Although the IRFI concept is simple, the logistics of implementing it are more complex. Any system needs to take into account the responsibility of the airport against that of the airline or pilot, and the balance between commercial pressures and safety. Any additional cost incurred by IRFI might be offset in the long run if airports or airlines could reduce conservative safety margins resulting from unreliable equipment or subjective procedures.

A key question raised during IMAPCR was whether it is necessary, or even possible, to regulate an IRFI. It is difficult to regulate a concept, but once the concept is embraced, there are aspects that can be regulated or better controlled. For example, performance criteria for friction measuring vehicles, the winter conditions in which they operate, the manner in which measurements are reported, the expiry times for condition reports and the legal implications. These are manageable in the short term and can offer immediate safety benefits.

Information for airport operators, which enables them to make best decisions about their runway friction measuring equipment requirements, for the accuracy, quality, and reproducibility they should expect, is currently unavailable. There are few local, and no international, mechanisms or bodies that monitor friction equipment and performance. Some friction testers have been on the market for years without development and there is no process for acceptance. The issue of an approval process will need to be addressed if the aviation community adopts the IRFI concept.

Various outstanding items were identified for further work:

- JWRFMP's extensive research data should be summarized, including the results and conclusions of more than 40 research reports and the proceedings of IMAPCR 2004.
- The harmonization and calibration of devices (master and local) need to be further refined against the IRFI standard device.
- A final decision is needed on the IRFI reference vehicle—IMAG, electronic recording decelerometer (ERD), or some other device. This will allow discrepancies between devices to be addressed and will also be beneficial for runway maintenance. Selecting the IRV means taking into account the congested airport environment typically found in Europe. It should also be able to take accurate readings on wet runways.
- The bulk of the data demonstrates that the ERD has the best correlation to aircraft braking coefficient (μ) on ice and compacted snow surfaces. Tests should be reviewed so that if IRFI is used as an international standard, procedures can be developed to establish a better correlation between an aircraft μ and IRFI.

Correlation with aircraft braking performance

The key objective of the research has been to demonstrate that a correlation between ground friction measurements and aircraft braking performance exists. This was clearly shown at IMAPCR—not only in theory but in practical application as well. Although some aircraft manufacturers have maintained that an aircraft's braking coefficient cannot be related to ground friction measurements, the results presented at IMAPCR seemed to demonstrate otherwise. As a result, the European Aviation Safety Agency (EASA) is considering amendments to their certification specifications for large aeroplane operation on contaminated runways to reflect these findings.

One of the most concrete developments to come out of the JWRFMP work is the Canadian Runway Friction Index (CRFI), which shows good correlation between friction values measured by the ERD and aircraft braking

performance. This is due to the consistency between surface friction, as defined by surface condition and the deceleration of both the aircraft and the ERD.

But while the research has shown that IRFI can be used to predict aircraft braking performance, data analysis suggests that converting CRFI to IRFI using harmonization constants may not be the solution, because the correlation to aircraft μ may be less reliable on certain winter surfaces.

Work is ongoing to determine whether IRFI readings can be used in the CRFI tables. If readings for similar surface contamination are not equivalent, IRFI landing tables could result in serious underestimation of aircraft landing distances under certain conditions.

As participants at IMAPCR 2004 pointed out, any system such as CRFI can have limitations. For example, it is dependent on the accuracy and timeliness of runway friction reporting. The CRFI is not aircraft-specific, which means that built-in safety margins may be too conservative for some aircraft. However, CRFI is built on actual flight test data, and currently provides advisory material where no other information may exist. For this reason, Transport Canada intends to propose the CRFI to ICAO as a recommended practice.

The need for the IRFI

The financial consequences of closing a runway can be significant to both the airport and the air operator. The question of legal liability for the consequences of any decision is a major one. Faced with a poor friction report, should the airport be obliged to take action, or should they simply be required to relay friction data, leaving the final decision whether to land in the hands of the pilot?

Some European airports, such as Munich International Airport have seen an increase in runway closures since deciding to impose their own operational limitations. However, Henning Pfisterer, Manager of Airport Safety at Munich, told IMAPCR that pilots would not have opted to land in 90 percent of closures, so the actual loss of runway time was insignificant. Mr. Pfisterer said the airport considers that taking the risk for the remaining 10 percent of cases to be a good business decision.

Airports globally are looking to ICAO to establish clearly-defined operational limitations on contaminated runways. Individual policies, such as those at the Munich airport, can only be considered an interim solution. Airport operators at IMAPCR clearly stated that international standards would not only make a contribution to flight safety, but also provide a reliable legal framework for the industry. They were also of the

opinion that the most important goal is to get the best information possible to pilots.

What's missing?

For airlines, there are procedural questions. Air Canada, for example, believes that fundamental problems with measurement timeliness and weather forecasting limit the relevance of runway condition measures at the time of flight dispatch. However, the airline considers near real-time friction reporting to be an achievable, significant safety improvement, and encourages further development. In relation to this, by utilizing the results from the JWRFMP, and synchronizing friction data with observations of contaminant type, Finnair has developed a decision-making tool that enables a pilot to perform calculations using the latest reported information.

There was a consensus at the meeting that friction reporting and measuring may be most useful for integrating into tactical decision-making tools and the provision of expiry times to ensure that obsolete data is not passed on to pilots. Airlines, such as Finnair, have demonstrated that a system can be implemented that results in improved safety and a decision-making tool, without imposing an additional regulatory burden. The question of legal liability in overriding manufacturer data was also raised as an issue. It was discussed that the CRFI sometimes permits landing when aircraft manufacturer guidelines recommend against it. Most are opposed to overriding manufacturer-provided landing information.

Furthermore, pilots present at the meeting stated that the most important consideration in using the work done by JWRFMP is ease of use. Captain Dennis Landry of Northwest Airlines, who is also Chairman of Special Projects for the Air Line Pilots Association (ALPA), told IMAPCR that those who develop the system must recognize that pilots need a simple solution. He stated that the CRFI system, although not officially adopted by the airline, is provided to the pilots and forms part of their general pilot education.

Kevin Hollands, Chief Pilot at Canada's WestJet Airlines, said the key consideration is how to apply techniques to strategic and tactical decision making regarding the safety of a runway. He said CRFI works because it has been accepted by pilots, uses standard techniques, and acts as a component of a system that can be used with standard aircraft movement surface condition reports.

Overall, the pilots agreed that a procedure is needed to link strategic and tactical decision-making tools regarding the suitability of a runway for landing. Manufacturers' data may be based on conservative estimates for surfaces such as ice, and therefore may not be used consistently.

The impact on aircraft manufacturers

While aircraft manufacturers provide operators with data to address contaminated runways, they do not provide any correlation of aircraft braking coefficients with runway friction. Since there is no common friction index for all devices, it is up to individual operators or authorities to relate the aircraft braking coefficients or wheel braking coefficients with a generic or airport-specific friction device.

Representatives from one major manufacturer told IMAPCR that while an IRFI appears capable of providing a more consistent way to assess runway friction for runway condition reporting, more work needs to be done to establish the correlation between the IRFI and aircraft braking. In particular, Boeing is concerned that the conservative assessments of braking required when using ground vehicle data may result in weight penalties that may not be necessary. It will be important to find a balance between the safety margin required and what an operator can accept.

Improving devices

It became evident at IMAPCR that manufacturers also need regulations and rules with some kind of independent review. There are currently no performance criteria that a manufacturer must meet. At the same time, some noted that introducing regulation into an unregulated industry will mean confronting issues such as competition between firms, vested interests, balancing commercial interests with client needs, standards that may raise costs, and even the possibility that some equipment may not meet regulations at all.

Frank Holt, Vice-President of Friction and Pavements at Dynatest International A/S, pointed out that the IRFI offers the advantages of acceptance; conformity of equipment, data and calculations; improved safety; and the elimination of substandard equipment and procedures. He said that an IRFI is possible, but authorities must take the lead and mandate it.

Participants generally agreed that adopting and putting into practice an international runway friction reporting system on an international scale requires the support and commitment of the international aviation community.

Conclusion

The interest and discussion generated at IMAPCR 2004 showed that measuring and reporting friction and relating it to aircraft landing distance remains an active concern. It was encouraging to see how different operators use data generated by the research program and apply it to their own operations.

A standard to calculate the IRFI has been developed by the American Society for Testing and Materials (ASTM) that accommodates all major measurement techniques and equipment currently used around the world. ASTM standards are in development for specifications for an IRV for IRFI, for the design and construction of an IRV, for a standard practice guide for friction measurements of aerodrome runways (WK5710), and for a standard practice guide for calculating an aircraft friction index (WK5711).

While development of a standard is an important step, it must be followed by implementation. Calibration of local measuring devices, for example, is critical. Once the final selection of the IRV has been made, a process for calibrating individual devices needs to be put in place. While the establishment of testing centres may offer a solution, it remains to be determined whether harmonization constants remain stable or whether individual devices would have to be retested or calibrated every year. There is some research that suggests that every three years would be sufficient. Manufacturers at IMAPCR raised concerns about who would bear the costs of calibration.

Many at IMAPCR 2004 agreed that an important next step is an independent assessment of whether in fact an international methodology can be developed. Several countries, including Canada, have proceeded to implement their own systems, which, while improving domestic safety, do not address the issue on an international level. Many participants suggested that ICAO should establish a working group to deal with the questions of standardization and new industry practices.

The general consensus at IMAPCR 2004 was that the aviation community needs to act on the current research findings. What is not clear is who will bear the cost.

Proceedings from IMAPCR 2004 were published on CD in the spring of 2005. For information on ordering, visit the Transportation Development Centre Web site at www.tc.gc.ca/tcdc/menu.htm. Δ

Call for Nominations for the 2007 Transport Canada Aviation Safety Award

Do you know someone who deserves to be recognized?

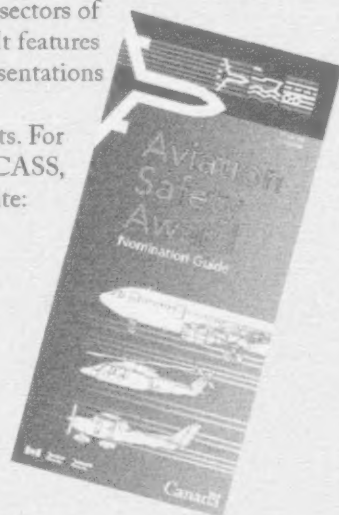
The Transport Canada Aviation Safety Award was established in 1988 to foster awareness of aviation safety in Canada, and to recognize individuals, groups, companies, organizations, agencies or departments that have contributed to this objective in an exceptional way.

You can obtain an information brochure explaining award details from your Regional System Safety Offices, or by visiting the following Web site: www.tc.gc.ca/CivilAviation/SystemSafety/brochures/tp8816/menu.htm.

The closing date for nominations for the 2007 award is December 31, 2006. The award will be presented during the 19th annual edition of the Canadian Aviation Safety Seminar (CASS 2007), which will be held April 30 to May 2, 2007 at the Hilton Lac-Leamy Hotel, in Gatineau, Que., located five minutes from downtown Ottawa, Canada's capital. The theme for CASS 2007 is "Counting the Accidents You Don't Have...Evaluating safety performance in a risk management framework."

CASS is an international event hosted annually by Transport Canada for all sectors of the aviation community. It features safety workshops and presentations by leading Canadian and international safety experts. For more information about CASS, visit the following Web site:

www.tc.gc.ca/CASS. Δ



To obtain a copy of the nomination brochure, Aviation Safety Award Nomination Guide (TP 8816), call 1 888 830-4911.

Call for Nominations—2006 David Charles Abramson Memorial (DCAM) Award



The DCAM Flight Instructor Safety Award recognizes professionalism and dedication in the world of flight instruction. Applicants for this prestigious award must possess superior teaching skills, outstanding leadership qualities, and must have demonstrated distinguished performance and devotion to the advancement of aviation safety. The deadline for submission is September 30, 2006. For complete details, visit www.dcamaward.com. Δ



MAINTENANCE AND CERTIFICATION

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Understanding the Successful Evacuation from an A340

by the Aircraft Certification Branch of Transport Canada, Civil Aviation

On August 2, 2005, an Airbus A340, with 309 passengers and crew aboard, overran Runway 24L at Pearson International Airport, in Toronto, Ont., and came to a stop approximately 200 m beyond the end of the runway in the Etobicoke Creek ravine. All passengers and crewmembers evacuated successfully before the post-crash fire consumed the airplane. The accident scene was shown live on television and widely reported in the media.



Many of the media commentators described the outcome as miraculous

While the Transportation Safety Board of Canada (TSB) is investigating, this type of accident scenario is considered in detail by Transport Canada and other regulatory authorities in developing the regulations applicable to the design of transport category airplanes, such as the Airbus A340. The primary objectives of these regulations are to prevent accidents and, when they do occur, to minimize injuries and fatalities. The latter involves providing a survivable environment for occupants during a crash landing, and the means to rapidly evacuate the airplane as soon as it has stopped, considering the possibility of fire. Some of the design-related regulations intended to improve survivability in a post-crash fire scenario are discussed below, and some advice is given on how we, as users of the system, can contribute to safety.

Impact sequence

For the accident to be survivable, the fuselage structure must remain substantially intact and provide a liveable volume for the occupants throughout the impact sequence. The cabin interior furnishings must not break loose and injure occupants or hinder rapid evacuation, and each occupant must be safely restrained until the airplane comes to a complete stop. Structural and crashworthiness requirements ensure these objectives are achieved in what the regulations describe as "a minor crash landing."

Consider an example such as the certification of seats. The seat and occupant restraint system must be designed to provide the same level of impact injury protection and structural performance as that provided by the airplane structure itself. Crashworthy seat design involves two major considerations. First, under high forward crash loads, the seat must not break loose from the floor, and the occupant must not suffer serious head injury when striking adjacent furnishings. Second, under high descent crash loads, the seat design must minimize the likelihood of serious spinal injury. The seat structural and occupant injury protection performance is verified during the certification process by dynamic tests of the seat assembly and occupants, who are represented by anthropomorphic test dummies with the physical characteristics of the average male (50th percentile). In the forward load test, the seat is brought to a stop from approximately 48 km/h in less than ¼ of one second. Parameters are measured throughout the deceleration pulse and must not exceed specific limits to prevent serious injury. High-speed cameras are needed to capture the action, millisecond by millisecond, to analyze the results.

External fuel-fed fire protection

Once the airplane has come to a stop, the next challenge is to safely and rapidly evacuate the airplane. Speed of evacuation is critical in the event of a water landing or where fire is a factor.

Survivability in post crash fire scenarios is related to how rapidly an external fuel-fed fire penetrates into and spreads within the airplane interior. Extensive research and testing has been conducted on ways to increase the useful evacuation time by delaying the spread of fire within the airplane. In 1978, the U.S. Federal Aviation Administration (FAA) established the Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee to examine the factors affecting the ability of the aircraft cabin occupant to survive in the post-crash environment, and the range of solutions available. The Committee was composed of fire safety experts from the National Aeronautics and Space Administration (NASA), the aerospace industry, and the general public.

Early efforts focussed on improving the flammability of cabin interior materials so as to delay the spread of interior fire and, in turn, delay a phenomenon known as "flashover." (Flashover is a condition in which certain gases and other products emitted during the combustion process and trapped in the upper portions of the cabin reach their auto-ignition

temperature and are ignited spontaneously.) Due to the almost total involvement of the cabin atmosphere, survival after flashover is virtually impossible. As a consequence of the Committee recommendations and research, conducted primarily at the FAA Technical Center in Atlantic City, two very significant regulations were adopted. The first regulation upgraded the material flammability standards for airplane seat cushions, as full-scale fire testing found these items to be the dominant factor in the spread of cabin fire. Research data indicated that an additional 40 seconds of useful evacuation time could be achieved from this change. While this may not seem substantial in absolute terms, it can be very significant in a time-critical evacuation. In the regulatory benefit analysis conducted at the time the regulation was adopted, a range of benefits was calculated, including a life-saving potential of 14 lives per year. The second regulation also substantially upgraded the flammability standards for other cabin interior materials, such as sidewalls, overhead storage bins, ceilings and partitions. Material meeting these standards further delays flashover.

As mentioned above, one of the key factors in determining useful evacuation time, and therefore survivability, is how quickly the external fire penetrates the fuselage. Recently-adopted regulations will require that thermal/acoustic insulation installed in the lower half of the fuselage of new airplane designs have a minimum of five minutes of fuselage burn-through protection. Longer-term research is underway with the objective of eliminating cabin interior material combustion products as a cause of death in airplane accidents.

Evacuation

There are many design regulations whose cumulative objective is to ensure that safe, orderly, and rapid evacuation is feasible. These include specifying the type and number of emergency exits that are required, the maximum distance between the exits, their distribution in the passenger cabin, the design of the means to open the exits under normal and emergency conditions, the markings and placards that inform passengers of the location and operation of the exits, emergency lighting and marking systems to ensure visibility under night conditions, and the provision of means (e.g. slides) to allow the passengers and crewmembers to descend safely to the ground from the passenger cabin exits. The ability to move from your seat to the exits is addressed by requiring minimum widths for longitudinal aisles and access paths from the aisles to the exits. Flight attendant stations must be provided in locations that ensure that cabins can be managed effectively under normal and emergency conditions and also be in close proximity to exits. These stations must protect the flight attendants during the impact sequence to ensure their availability to manage the subsequent evacuation.

The escape slides provided to safely reach the ground are worthy of some discussion. They are typically inflatable

devices stowed on the door itself. As the door is opened in an emergency, the slide is pulled from its stowed position. As the slide drops, the inflation cycle begins and the slide erects very quickly. If automatic inflation does not occur, there is a means to manually activate the inflation system. On an Airbus A340, the passenger emergency exits are approximately 5 m above the ground with the landing gear extended normally. These distances may increase or decrease for landing gear failure conditions, and the escape slides must still be useable. They must be capable of deploying in windy conditions, up to 25 kt, and resist radiant heat from a fuel-fed fire. Typical wide-body airplane exits must be capable of being ready to allow evacuation to commence within 16 seconds from the beginning of the exit-opening sequence. On airplanes involved in extended over-water operations, slides are often designed to function as life rafts in the event of a water landing.

In addition to the regulations that specify the above features, there is also a requirement for manufacturers of airplanes with more than 44 passenger seats to show that all occupants can be evacuated from the airplane to the ground under simulated emergency conditions within 90 seconds. Compliance is typically shown by a full-scale demonstration using a representative passenger complement and a trained crew, and using half of the available emergency exits. This standard is intended to demonstrate emergency evacuation capability under a consistent set of prescribed conditions, but is not intended to demonstrate that all passengers can be evacuated under all conceivable emergency conditions.

Overview

Each accident is unique, and usually the result of a multitude of factors. However, the design regulations are updated continuously to address specific accident scenarios based on in-service experience. The above provided an overview of some of the post-crash fire design related regulations that airplane manufacturers must address in order for aviation regulatory authorities to issue a type certificate for a new airplane design. These are part of the overall system that regulates the design, manufacture and operation of aeronautical products. Of course, the users of this transportation system also have an important role to play in achieving the required level of safety, and this will now be discussed in the conclusion of this article.

Airplane design and the role of the passenger

Should you have the misfortune of being involved in a time-critical evacuation, you can, by establishing a simple pre-flight routine and following the crewmembers' instructions, maximize the possibility of a successful evacuation, similar to this event.

Establish a routine that ensures you're knowledgeable about the airplane you are about to travel in. Make a conscious effort to understand the interior design features provided for your safety. Begin as you arrive at the airplane. Note

how the entry door looks in the open position and read the instructions on how it is opened. As you enter the airplane, note the position of the opposite exit, look for the exit marking signs above the exits and the exit locator signs, typically located above the aisle in the area of the exit access paths. As you make your way to your seat, observe the cabin layout and the location of any other exits you pass, as well as the opening instructions. Once you are comfortably seated, use the opportunity to set a good example for your fellow travellers by fastening your seat belt and finding and studying the safety features card located in the seat pocket in front of you. It will reinforce the information you acquired on the way to your seat and provide additional information on the location and operation of exits behind you. Work out a plan on how you would find the nearest exits, both forward and aft of your seat, even in darkness. Be sure you know how to operate these exits unassisted. Remember that an exit should not be opened when the external conditions would make it unsafe to do so, e.g. fire, or flooding if the exit is below the waterline. Make sure you understand the floor proximity marking system provided to guide you from your seat to an exit. Look at the illustration of the brace position required in an emergency. Become familiar with the safety features card instructions on how to don oxygen equipment in the event of pressurization system failures and the location and use of survival equipment provided for a water landing.

Pay special attention to the safety briefing that will provide you with further details on the airplane features and safety equipment, as well as information on expected behaviour on issues such as when and where to stow carry-on items, what electronic devices may be used, and the prohibition of smoking.

As the take-off roll begins, make sure your seat belt is adjusted so it sits snugly over your hips; this is very important if you are to benefit fully from the injury protection intended by the seat certification process. Repeat this prior to landing. It is recommended that you keep your seat belt fastened at all times during flight in case of unexpected turbulence. Follow your routine each time you board an airplane. Remember that your airplane may be equipped with different exit types and opening methods and that different models of the same airplane types may have unique features that you need to understand.

Flight attendants are trained to react quickly and manage any emergency that may be encountered. Follow their instructions throughout the flight as the regulatory requirements they enforce are aimed at enhancing survivability. Any questions should be raised with a flight attendant before takeoff commences.

For additional information, visit www.tc.gc.ca/CivilAviation/commerce/CabinSafety/tips/menu.htm. 

The Importance of Following Policies and Procedures—Fact or Fiction?


by Keith Parsons, Civil Aviation Safety Inspector, Atlantic Region, Transport Canada

In a previous life, while I was employed as Quality Manager at an approved maintenance organization (AMO), I held the position of chairperson of the health and safety committee, where I had the opportunity to investigate an accident involving an aircraft maintenance engineer (AME) who was injured while servicing a nitrogen bottle.

It was a normal working day in an active hanger, where several commercial aircraft were undergoing heavy maintenance. In a neighboring hangar, a technician had just successfully completed a scheduled task of deploying the pontoons on a Bell 206. The system used for deployment utilizes a nitrogen bottle with a shear head and squib activated by a switch in the cockpit. Following the successful deployment, the technician removed the nitrogen bottle from the helicopter, replaced the shear head and transported the bottle to our hangar for servicing. The supervisor on duty, who knew the technician, elected to fill the bottle himself. He placed the empty nitrogen bottle on a mobile table and positioned the portable stand-up nitrogen cart, carrying two nitrogen bottles with a regulator and stainless steel hoses, along side. After making the necessary connections, the filling process began; however, as the pressure passed 1 500 PSI, the shear head failed or activated, and a high volume discharge occurred causing the nitrogen bottle to make a quick violent spin impacting the

supervisor in the stomach and throwing him 15–20 ft. The now out-of-control bottle, attached only by the stainless steel hose, wrapped the hose around itself until it was tight against the top of the nitrogen cart. The discharge port of the shear head was now facing the floor and propelled itself upward along with the two full vertical nitrogen bottles until the discharge could no longer sustain lift, and the now three nitrogen bottles came crashing to the hangar floor. Wow—all in the matter of seconds.

That covers the who, where, when and how; now, the why. The procedure for servicing the bottle, which was available, was to secure the bottle during filling using appropriate clamps or the designed aircraft installation, but for whatever reason, this was not followed. I used this incident as part of the AMO's delivery of initial training to highlight the importance of using the proper procedures when carrying out tasks to all the new hires.

My thoughts on this incident can be summed up in one word—lucky. We were extremely fortunate that this incident did not turn out a lot worse. Now, here comes the advice. In this aviation world, which we have elected to become part of, there are hazards and risks that exist daily, and we must remain aware, never let down our guard, be professional, and above all, be safe at all times. 



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Obstacle Clearance During Takeoff

by Captain Robert Kostecka, Civil Aviation Safety Inspector, Foreign Inspection, International Aviation, Civil Aviation, Transport Canada

A failure to understand some of the important aspects of aircraft performance can have a tremendous impact on flight safety. It is not hard to imagine a situation where a lack of aircraft performance knowledge could have catastrophic consequences.

Let's assume that you are the Captain of a Transport Category jet aircraft that is about to depart from Québec City on a flight to Europe. Tonight your aircraft will be very heavy. You are carrying a full load of passengers and are tankering extra fuel. The weather is 300 ft overcast, 1 mile in rain showers. As you taxi to position on Runway 06, you review the Québec Two Departure again: "Climb to 'BV' NDB then track 064° outbound..." maintain 4 000 ft.

You advance the thrust levers and the aircraft accelerates down the runway. Your First Officer calls "V1," then "rotate" and you smoothly pitch the nose up. As the aircraft lifts into the night sky, your First Officer advises, "positive rate," and you reply, "gear up."

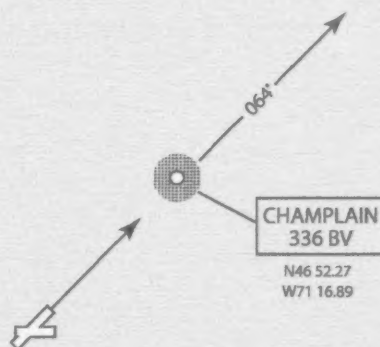
Just after you become airborne, the No. 2 engine fails. Instinctively, you apply rudder to control the yaw and adjust your pitch attitude. You fly the aircraft smoothly and precisely. Your many years of training appear to be paying off. It flies just like the simulator, you quietly think to yourself.

As per your company's standard operating procedures (SOP), you engage the autopilot, select heading mode and call for the engine failure drill. You continue to follow the Québec Two Departure: "Climb to 'BV' NDB then track 064° outbound..." As your First Officer proceeds with the drill, the ground-proximity warning system suddenly barks: "Too low, terrain." This can't be right, you think, as your heart races. Your eyes dart to the vertical speed indicator. It indicates that you are in a steady climb. But the radar altimeter only shows 100 ft—and it is decreasing rapidly. You have no time left to understand what is happening.

How could this occur? Why would an aircraft that is being flown smoothly and precisely impact the ground? Aren't Transport Category aircraft supposed to have sufficient climb performance—even with an engine failure? Isn't obstacle clearance guaranteed if we fly the published instrument departure procedure? Most importantly, how can we ensure that an accident like this

doesn't actually happen? These are important questions. In answering them, we'll review some of the important issues of aircraft performance.

NOT FOR NAVIGATION



DEPARTURE CLIMB RATE V/V (FPM)

GROUND SPEED	90	120	140	160	180	200	250	300
290 FT/NM	440	580	680	780	870	970	1210	1450

DEPARTURE ROUTE DESCRIPTION

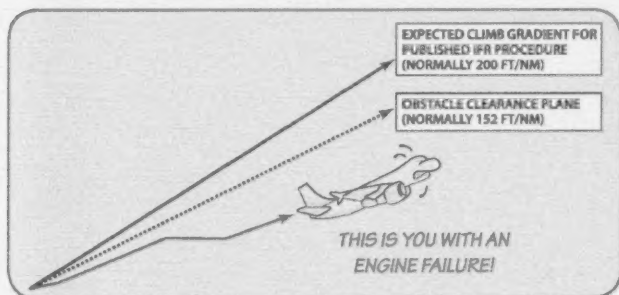
- Rwy 06:
1. Climb to 'BV' NDB then track 064° outbound or on assigned heading by ATC for radar vectors.
 2. All acft maintain 4000 ASL or as assigned.

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It is vitally important for pilots and air operators to realize that the obstacle clearance provided by a published instrument departure procedure is based on all-engine aircraft performance. Following a published instrument departure procedure will not necessarily guarantee obstacle clearance following an engine failure.

To begin, we must understand the obstacle clearance requirements for published instrument departure procedures. These can be found in Transport Canada publication TP 308, *Criteria for the Development of Instrument Procedures*. TP 308 states that an obstacle clearance plane, with a slope of 152 ft/NM, is required. Aircraft must remain above the obstacle clearance plane and are expected to maintain a climb gradient of 200 ft/NM. In the event that an obstacle penetrates the normal obstruction clearance plane, a climb gradient greater than 200 ft/NM is specified. This is the case in Québec City, where aircraft are expected to climb at least 290 ft/NM.

It is vitally important for pilots and air operators to realize that the obstacle clearance provided by published instrument departure procedures is based on **all-engine** aircraft performance. In the event of an engine failure, the aircraft may not be able to achieve the required climb performance. Following a published instrument departure procedure will not necessarily guarantee obstacle clearance following an engine failure.



The aircraft's climb performance with an engine inoperative may not meet the obstacle clearance requirements provided in published instrument departure procedures.

The regulations require airline operators to limit weight during takeoff so that the aircraft will clear all obstacles during takeoff—even with a failure of the most critical close-up engine. Subsection 705.57(1) of the *Canadian Aviation Regulations* (CARs), *Net Take-off Flight Path*, specifies that, “No person shall conduct a take-off in an aeroplane if the weight of the aeroplane is greater than the weight specified in the aircraft flight manual as allowing a net take-off flight path that clears all obstacles by at least 35 ft vertically or at least 200 ft horizontally within the aerodrome boundaries, and by at least 300 ft horizontally outside those boundaries.” (The “net take-off flight path” is the aircraft’s actual or “gross flight take-off flight path”—that was determined through flight testing—decreased by a margin. For two-engine aircraft, the gradient is reduced by 0.8 percent. This margin is intended to account for less-than-perfect pilot technique and slight degradations in aircraft performance.)

Airlines comply with this regulation by considering the obstacles in the take-off path and verifying that their aircraft will clear all obstacles by the required margin. In addition to obstacles, this analysis considers all of the factors that could affect the takeoff: the characteristics of each individual runway—including the slope, pressure-altitude, ambient temperature and wind component. This information is used to produce special charts that are known as Airport Analysis Charts. (Some air operators refer to their Airport Analysis Charts as WAT Charts.)

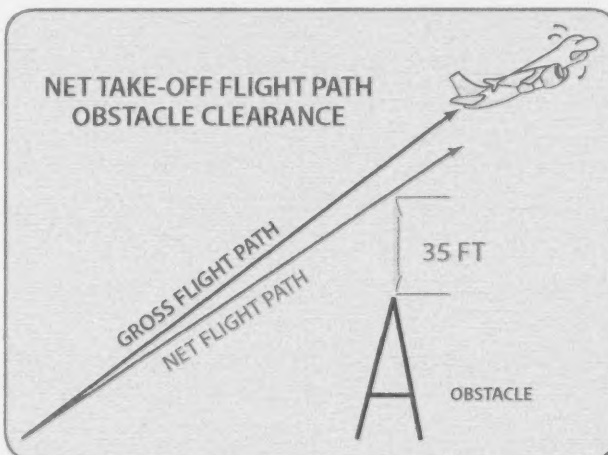
Airport Analysis Charts specify the maximum allowable weights for takeoff under various conditions. This data is based on the aircraft following a specified engine-out path during the takeoff. The airline may choose to follow the published instrument departure procedure or they may

choose a straight-out path, along the extended runway centreline, as their standard engine-out flight path.

In some cases, because of high terrain or other obstacles, following the published instrument departure procedure or a straight out path will not provide the required obstacle clearance following an engine failure. In these cases, “special” engine-out departure procedures—that allow obstacles to be avoided laterally—are provided. These special procedures include a turn (or a series of turns), as well as the specific headings or tracks that must be flown in order to avoid obstacles.

In our fictional engine failure during takeoff that we discussed earlier, the aircraft ran into the high terrain that is northeast of the ‘BV’ NDB. This could have been prevented if the proper engine-out path—on which the Airport Analysis Chart was based—had been followed. This special engine-out procedure required the aircraft to turn right at the ‘BV’ NDB, so that the obstacles could be avoided. (Instead we followed the published instrument departure procedure.)

It is important to understand which procedure has been used to establish the engine-out departure path. If an engine failure occurs, flight crews must know whether they should follow the published instrument departure procedure, fly straight-out on the runway heading, or follow a “special” engine-inoperative procedure.



Weight must be limited so that the net take-off flight path will clear all obstacles by at least 35 ft vertically (CAR 705.57). The “net take-off flight path” is the aircraft’s actual or “gross flight take-off flight path”—that was determined through flight testing—decreased by a margin that is intended to account for less-than-perfect pilot technique and slight degradations in aircraft performance.

Increasing the altitude for level acceleration and flap retraction (extending the second segment of climb) is another method that is used to ensure obstacle clearance. Pilots must know if the engine-out procedure requires this technique. In addition, if a special engine-out

procedure has a turn (or a series of turns), pilots should know whether they should delay flap retraction until after completion of the turn. (This is because of the effect of acceleration on turn radius.)

In an emergency, pilots are authorized to deviate from published instrument departure procedures in order to ensure obstacle clearance with an inoperative engine. (An emergency should be declared as soon as practicable, so that air traffic control is alerted and can take appropriate action.) These special engine-out procedures allow airlines to carry profitable payloads, and still comply with the engine-inoperative obstacle clearance requirements of CAR 705.57, *Net Take-off Flight Path*.

When obstacles such as high terrain are a factor, it is important to have a way out should an engine fail. Properly-designed engine-inoperative take-off procedures will ensure that the aircraft is able to achieve a safe altitude. These procedures should terminate with the aircraft at minimum radar vectoring altitude, minimum sector safe altitude or 100-mile safe altitude. The obstacle clearance requirements for takeoff described in CAR 705.57, *Net Take-off Flight Path*, must be complied with until the en route obstacle clearance criteria of CAR 705.58, *Enroute Limitations with One Engine Inoperative*, can be met. Net take-off obstacle clearance requirements do not always end at 1 500 ft above ground level (AGL) or at an arbitrary distance from the runway.

Flight Following

by Michael Oxner

The Transport Canada *Aeronautical Information Manual* (TC AIM), RAC 5.7, calls it "en route radar surveillance." Most pilots and controllers I talk to, call it "flight following." Whatever you call it, it's a service available to VFR pilots, and making use of it means that the air traffic controllers in the area control centres (ACC) are watching over your flight through the use of radar.

If you're on a VFR cross-country flight, the progress of your flight is monitored by flight information centres (FIC) for alerting services, normally done through position reports. However, if you're within radar coverage, you can call ATC and ask for radar flight following as an additional service. In this article, we'll talk about the benefits of radar flight following service, its limitations, and what's expected of you when you make that call.

First things first. If you don't have a transponder, ATC won't be able to watch your flight outside of terminal areas. The reason is that many radars across the country are secondary surveillance radar (SSR)-only, a lot like the traffic alert and collision avoidance system (TCAS). If your flight takes place outside of radar coverage, you won't be able to take advantage of this service. Your altitude and

A diversion to an alternate airport due to poor weather or a medical emergency can pose unique challenges. In addition to having correct take-off data for airports that are normally used by the airline, it is recommended that arrangements be made for obtaining take-off data in the event of an unscheduled diversion. Pilots and dispatchers should know how to obtain accurate take-off data—which properly assesses obstacles—when an aircraft has had to make an unscheduled landing at an unfamiliar airport.

Good airmanship requires us to expect the unexpected. To fly safely, we must anticipate what can go wrong—and develop a plan. The engine-out departure paths, on which the Airport Analysis Charts are based, provide a plan that allows airlines to take off at heavy weights, while still ensuring obstacle clearance in the event of an engine failure. Δ

References:

- TP 308, *Criteria for the Development of Instrument Procedures*
- CAR 705.57, *Net Take-off Flight Path*
- CAR 705.58, *Enroute Limitations with One Engine Inoperative*
- TP 12772, *Aeroplane Performance*

Prior to joining Transport Canada, Captain Kostecka worked as a pilot and instructor for several Canadian airlines. He has flown over 12 000 hr and holds type ratings on the A320, A330, A340, B757, B767, CRJ, DHC-8 and B-25.

terrain must be taken into account when thinking about radar coverage. If you're behind a mountain, or simply too low, ATC won't be able to see you. The TC AIM contains more information in RAC 1.9 about where transponders are required, their operation, as well as a diagram giving you an idea of where radar coverage extends in Canada.

Another basic requirement, of course, is a radio. You'll need the radio to make the request for flight following. And once on the ATC's frequency, you're expected to remain there. It is understood that you may have other radio calls to make, including mandatory frequency (MF) calls, updates to flight plans and so forth. If you must leave the ATC's frequency, make sure you let them know that you'll be off the frequency and how long you expect to be away. Far too many pilots make the request for flight following, are radar identified, and then leave the frequency. ATC can't provide you with traffic information if you're not listening.

When being provided with flight following, ATC will provide information on known IFR and VFR traffic operating in your area. Navigation assistance may be provided upon request as well. Sometimes a pilot gets himself turned around, especially at night, and a simple

request can be made to ATC for a position relative to a fix or location, or even a radar vector to get back on course. Even something so trivial as a groundspeed check can be obtained.

While weather information may be provided in terminal areas, ATC has little or no weather radar coverage outside these places. Lightning data is available in the ACC areas as well, which means that even if ATC can't see the precipitation, they may have an indication of thunderstorm activity along your intended route of flight.

If you experience an emergency in flight while receiving flight following, your last known radar position may help speed search and rescue (SAR) to your location.

ATC may also be able to benefit from VFR aircraft in communication with them. For example, if one of their IFR aircraft approaches your flight, ATC will know what you're doing, and will have verified your Mode C altitude. This may save them from wasting precious radio time if your flight really isn't traffic. If a conflict may occur, talking to both aircraft involved can increase the likelihood of an easy resolution.

For all the benefits, flight following has its limitations. Pilots must, as mentioned earlier, monitor the ATC's frequency to get the benefit of the service. Also, traffic without transponders cannot be seen by ATC outside of terminal areas. Some things you can't control as a pilot when asking for flight following are workload or equipment issues faced by ATC. For example, a radar outage may prevent you from receiving the service. Since the IFR ATC units are primarily responsible for the provision of separation and flight information services to IFR aircraft, services to VFR aircraft are secondary and workload may preclude the provision of flight following. A quiet frequency doesn't mean the controller isn't busy behind the scenes any more than a pilot being quiet on his radio while on final doesn't mean he isn't focused on landing his airplane.

There's the Aerodrome Beacon And...

by Bob Grant, Civil Aviation Safety Inspector, Aerodromes and Air Navigation, Civil Aviation, Transport Canada

Since the pilot had never flown into the destination aerodrome before, he planned the trip to end just before dark. Unfortunately, due to stronger-than-forecast winds and a refuelling delay at the last aerodrome, the pilot's takeoff for the last leg took place just after sunset. Right before departure, the pilot received a thorough weather briefing, checked the *Canada Flight Supplement* (CFS) for lighting available at the destination aerodrome, and filed a flight plan for the three-hour flight.

The trip was uneventful, but with an overcast ceiling at 8 000 ft and no moon, it was dark...very dark. The small aerodrome was 10 mi. north of the town where the pilot was to attend a meeting. His plan was to follow the highway that passed just north of the town until he had the

One of the big things to realize when flying with flight following, is what class of airspace you're in, and what your responsibilities are within it. For example, if you're VFR in Class C airspace, you must adhere to the clearance issued by ATC. If you're in Class E airspace, your altitude and heading are your responsibility, and ATC has neither the responsibility nor the authority to assign either. If you're planning to change altitudes, or even destination, while being provided with the service, you should keep ATC in the picture so they know what you're up to. As a pilot, you are responsible for knowing what class of airspace you are in, and when you transition from one to another.

When requesting a radar vector for navigation assistance, you must also remember that, while operating under VFR, you are responsible for avoiding terrain, obstructions and IFR weather conditions, as well as other traffic. Remember that the rules of VFR flight still apply, including watching out the window.

While there is little specific information in the TC AIM regarding en route radar surveillance, the following paragraphs in the TC AIM will help answer some questions and provide more information:

- COM 3.14 Radar
- RAC 1.5 Radar Service
- RAC 1.9 Transponder Operation
- RAC 2.5 Controlled Airspace
- RAC 2.7 Low Level Controlled Airspace
- RAC 2.8 Classification of Airspace
- RAC 5.6–5.8, includes information on VFR in Class C and controlled VFR (CVFR) procedures. Δ

Michael Oxner is a terminal/enroute controller in Moncton, N.B., with 14 years of experience. He is a freelance aviation safety correspondent for www.aviation.ca.

aerodrome beacon. When he was, by his calculations, about 30 mi. from the aerodrome, he spotted what appeared to be the aerodrome rotating beacon. He was sure it was the aerodrome, but the light looked different than any other aerodrome beacon he had ever seen before. There was a white flash, followed by another white flash, then a pause, and then the sequence repeated over again...white, white, and then nothing. He decided to fly toward the beacon for 15 or 20 min before transmitting on the aircraft radio control of aerodrome lighting (ARCAL) frequency to activate the runway lights. After 10 min or so, he noticed the light now presented a white, white, red sequence. He thought this a bit strange and planned to check with the aerodrome manager the next day. He made the appropriate calls on the mandatory frequency (MF), and when he was

about 5 mi. from the beacon, he keyed his microphone the number of times indicated in the CFS and waited for the lights. When they didn't appear, he tried again...still no lights. No problem, he thought. He planned to overfly the field at mid-point, check the wind and runway, and try the ARCAL again. When he overflew the light, still without seeing the aerodrome, he was amazed to see, instead of the aerodrome, a 300-ft communication tower. Since he still had to find the aerodrome, he started a right turn to get back to the town, and he keyed the ARCAL once more. Much to his relief, runway lights soon appeared along with a very bright strobe light. He now had more questions for the aerodrome manager, and perhaps one or two for Transport Canada.

Why didn't he see the aerodrome strobe light, since he had passed 7 mi. south of it as he headed toward the rotating beacon? The answer is, because it wasn't on. Instead, it came on with the runway lights when he activated the ARCAL, and by that time, the aerodrome was behind his right wing and his concentration was focused on the beacon. More and more aerodromes are activating "ALL" of their aerodrome lighting with the ARCAL as an energy-saving measure.

For years, aerodrome acquisition beacons were white rotating lights, flashing between 20 and 30 times per minute. On the other hand, towers, chimneys, supports for wires across rivers and valleys, and any other man-made obstacle deemed to be a hazard to aviation, were, depending on their height and location, marked with red or white lights or strobe lights, or a combination thereof.

To further muddy the water, aerodromes certified for night operation may use either rotating white beacons or strobe lights as aerodrome beacons.

The regulation regarding lighting of obstructions is *Canadian Aviation Regulation (CAR) 601.19—Orders Regarding the Marking and Lighting of Hazards to Aviation Safety*, www.tc.gc.ca/CivilAviation/Regserv/Affairs/cars/PART6/601.htm#601_19, and the standard pertaining to that regulation is *CAR 621.19—Standards Obstruction Markings*, www.tc.gc.ca/CivilAviation/Regserv/Affairs/cars/PART6/Standards/62119.htm. Standards regarding aerodrome beacons can be found in *Aerodrome Standards and Recommended Practices (TP 312)*:

5.3.3 AERODROME BEACON

Characteristics

5.3.3.4 Standard—The aerodrome beacon shall show white flashes. The frequency of total flashes shall be from 20 to 30 per minute.

5.3.3.5 Standard—The light from the beacon shall show at all angles of azimuth. The vertical light distribution

shall extend upwards from an elevation of not more than 1°. The effective intensity of the flash in white shall not be less than 2 000 cd.

Note 1: Aerodrome beacon may be of two types, the rotating beacon or flashing capacitor discharge light.

Note 2: At locations where a high ambient background lighting level cannot be avoided, the effective intensity of the flash may be required to be increased by a factor up to a value of 10.

In addition to the two approved light types, some aerodromes certified for night operations may be exempted from the requirement to show an aerodrome beacon:

Application

5.3.3.1 Standard—An aerodrome beacon shall be provided at each aerodrome intended for use at night, except when, in special circumstances, the beacon is considered by the Certifying Authority as unnecessary upon determination that it is not required by one or more of the following conditions:

- the aerodrome is located on or near a frequently used night VFR route.
- the aerodrome is frequently used by aircraft navigating visually during periods of reduced visibility.
- it is difficult to locate the aerodrome from the air due to surrounding lights or terrain.

All of the above taken into consideration, an aerodrome certified for night operations may or may not require an aerodrome beacon. If a beacon is required, it may be on from dusk till dawn or it may be on only when the ARCAL system is activated, and the light may be a rotating beacon or a flashing capacitor discharge light (strobe). Since there are a number of variables with respect to aerodrome lighting, one should pay very close attention to the lighting section in the CFS when planning a flight.

Example:

FAIRMONT HOT SPRINGS, B.C. (CYCZ),
Lighting: ARCAL—123.2 type K.
 ARCAL opr A/D beacon

The ARCAL installed at CYCZ is a type K system. It controls the aerodrome lighting, including the aerodrome beacon, through the appropriate use of the aircraft radio tuned to 123.2 kHz.

Returning to the white, white, red rotating beacon on the communication tower, *CAR 621.19—Standards Obstruction Marking* specifies such things as, photometric output, beam spread, flash rate, flash duration, intensity control and synchronization as some of the characteristics that a lighting system should have. The standard does not

specify types of light that may be used. That being the case, a rotating light on a tower is OK, provided it meets the standards listed in CAR 621.19.

Well, you say, that's all good information but...why white, white, red? A number of years back, a Canadian lighting manufacturer produced a light (rotating beacon type, producing 40 flashes per minute), which was intended as an alternative, not a replacement, for obstruction lighting. The traditional method of lighting before the "new light" was with a capacitor discharge (strobe) system. The light was evaluated at a number of Canadian locations, and any light that was fairly close to an aerodrome was generating

complaints and concerns. Pilots were saying that the light was being confused with the aerodrome beacon. The solution was to make the third and sixth lens in the light red. The reason the pilot saw white, white, pause at 30 mi. was because he was too far away to see the light passing through the red lens. Since the change (a simple one) to white, white, red, there have been no further complaints.

Because of the various lighting configurations and activation methods, a very thorough study of the CFS and appropriate maps is strongly recommended; even more so if you are going into an aerodrome for the first time. Δ

Power Parachute Steering Line/Riser Wrapped on Outrigger Arm

The following is based on a safety information letter from the Transportation Safety Board of Canada (TSB).

On August 27, 2005, a Six Chuter Skye Rider Powered Parachute (Aerochute) departed from a field with a pilot and one passenger on board. The parachute canopy did not inflate evenly during the take-off roll. After takeoff, the powered parachute climbed to about 50 ft above ground, entered an uncommanded turn to the left, and plunged to the ground. Both occupants were seriously injured, and the powered parachute sustained substantial damage.

The pilot encountered control difficulties immediately after lift-off, and at that time, it was observed that a stainless steel riser cable was looped around the left outrigger arm. The pilot and passenger attempted to slide the riser cable over the end of the outrigger to remove the loop; however, the cable was taut and could not be repositioned due to the air loads on the canopy. The left turn progressed to a tight left spiral, and the parachute collapsed prior to the cart impacting the ground.

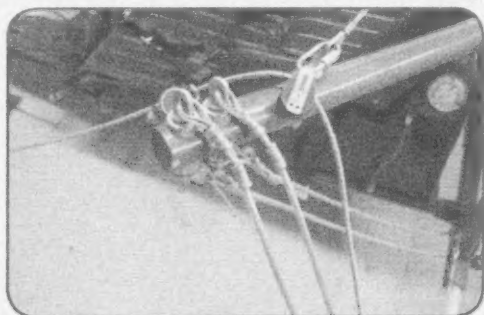


Figure 1. Close-up of left outrigger and eye bolts, with the riser cables in the correct pre-flight position

The pilot held an ultralight pilot permit, restricted to powered parachutes, with an instructor rating. He had approximately 175 hr of powered parachute flight experience. The weather was clear and calm at the time of the accident, and the temperature was about 25°C. The field was approximately 3 800 ft above sea level (ASL).

The wreckage was examined and no pre-impact mechanical discrepancies were identified.

The powered parachute utilized aircraft-grade eye bolts to attach the stainless steel riser cables to the outboard ends of the outrigger arms. The nicopress thimble-eyes on the riser cables allowed the riser cables to move freely in the eye bolts. The steering lines were routed through hardware mounted inboard of the eye bolts (see Figure 1). Newer versions of the aircraft utilize a slightly more rigid system of shrouded nylon riser straps in place of eye bolts and cables (see Figure 2).

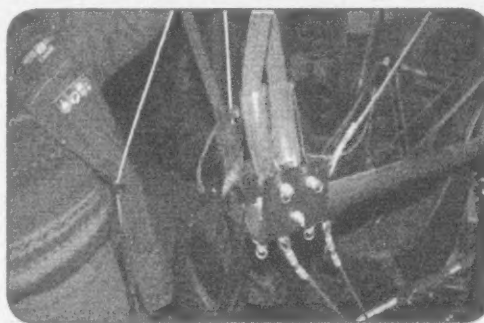


Figure 2. Close-up of newer design riser straps in the normal in-flight position

With either system, a pilot must verify that the steering lines, risers, and suspension lines are correctly positioned above the outrigger arms on the pre-flight check, by "walking the lines" with the parachute canopy and suspension lines laid out behind the cart. Standard practice also requires that the pilot apply partial power to get the cart rolling slowly at the beginning of the take-off run, and then conduct a "shoulder check" to the left and right as the parachute rises over the cart, to visually confirm that the steering lines and risers are correctly positioned above the outrigger arms. If a riser or steering line wraps around an outrigger, the wrap will effectively shorten the riser or steering line, which precludes proper chute inflation (see Figures 3 and 4).

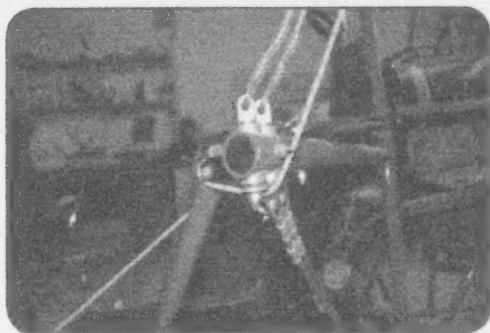


Figure 3. Photo of the steering line wrapped around the outrigger, with the riser cables upright in the normal in-flight position

The *Operator's Manual* emphasizes that during takeoff, the pilot is to perform a visual scan to ensure that the chute is overhead and centered, that the chute is pressurized, that the end cells on both sides are open, that the risers and lines show no tangles, and that the steering lines are free of tangles and properly positioned. It also contains a warning that a chute that is not fully and properly inflated before takeoff may result in total loss of control of the aircraft and serious injury or death. A pilot must abort the takeoff immediately if the chute does not inflate normally.

Power parachute owners commonly install and use mirrors to check canopy inflation, and a large round convex mirror had been mounted on the cart, directly ahead of the front seat. Six Chuter Inc. does not endorse the use of a mirror as the primary means of conducting a

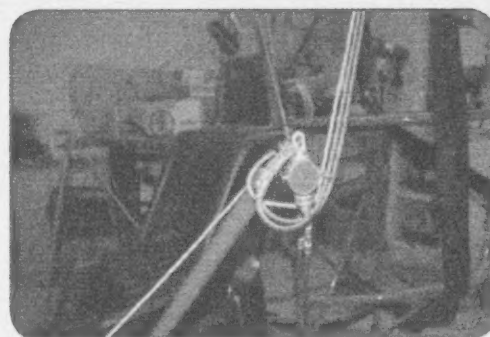


Figure 4. Photo of riser cables and steering line wrapped around the outrigger arm

steering line, riser cable, or canopy check for a number of reasons. The outrigger arms, steering lines and risers may not be within the normal field of view of a mirror, and a mirror image may be too small to provide sufficient detail to recognize the positions of steering lines and riser cables relative to the outrigger arms on takeoff. As well, a mirror image is reversed, which may contribute to the application of inappropriate control inputs while keeping the chute centered over the cart during takeoff.

A powered parachute canopy will not inflate properly during takeoff if a steering line and/or a suspension cable becomes wrapped around an outrigger arm. As demonstrated by the circumstances of this accident, a wrapped steering line or suspension cable can result in a loss of control after takeoff. Δ

It Won't Happen to You, of Course...But What if it Does?

by Bob Merrick. Bob is a System Safety alumni who promotes aviation safety in all he does. He writes regularly for COPA News.

In the bad old days, when aviation was in its adolescence, arriving at a destination was not a sure thing. Engines were random contraptions, NAVAIDS tended to be trees, rivers and other sites that obstinately hid behind clouds or fog at inconvenient times, and the magic 1-800 number to reach the forecaster was not yet in service.

These hazards were well-known, and there were some lesser-known problems that also produced impromptu sleep outs, so prudent aviators planning lengthy trips were careful to include survival gear among their preparations. Why? First, the aircraft they were in had its limitations. Second, there was no vast fleet of search and rescue (SAR) aircraft standing by, and third, there was no way to promptly notify them if there had been.

But, this changed. Aircraft became more reliable, NAVAIDS improved and proliferated, and even though there is no "vast fleet of SAR aircraft" standing by, there is an adequate supply of them to pluck people from the

wilderness relatively quickly. Thus, SAR philosophy has changed from: "prepare for a lengthy stay in the Great White North," to: "we'll have you out in a few days, at worst."

No longer do aircraft leave the ground with 90 percent of their cargo capacity given over to the survival gear that had a good chance of being needed. No longer do the crews sit in the cockpit all bundled up in bunny bags and mittens. With better heaters, fewer drafts and less chance of crashing, who needs all that stuff?

Well, you just might. According to one long-ago SAR pilot, the pendulum may have swung too far the other way. He retains his interest in aviation, and frequently visits smaller airports, watching aviators prepare for flights. Too often, he is appalled by their attire. Fashion, rather than protection, seems to be the goal, and some people routinely soar aloft in clothing more suited for Caribbean beaches than an overnight or longer stay in the Canadian backwoods.

What's your sartorial preference when leaving on a winter flight? A warm, fuzzy bunny-bag jacket, or something flimsy, with a designer label, showing how trendy you are? Some lounge-lizard loafers to knock them dead in the next fixed-base operator (FBO) lounge? You may wish to consider your wardrobe before launching. Sure, there is survival gear in the aircraft, but sometimes airplanes burn following unusual landings, the survival stuff goes with it, and you're left with what you have on your back and in your pockets.

In winter, what should be in your pockets? Matches, not only for starters, but also for fire starters. Someone who tried it several years ago opined that, after a crash, there was no way of having too many matches, and it's nice if those matches are in waterproof containers. A signalling mirror can help attract attention. Mitts, toques and boots with thermal socks may not look stylish, but they can ward off the frostbite that is an ever-present, deadly danger in the Canadian North.

"That's nice," you say, "but I don't fly in the winter. What do I care about things to wear?" Do you think the long-ago SAR pilot doesn't have some thoughts about you, too? "I've seen people in swim suits and flip-flops leap into a little airplane and go flying. What are they thinking of?" Yes, indeed, what are they thinking of? Although the number of airplane fires is greatly reduced, the risk is still higher than you might think, and one layer of clothing—provided it's not the synthetic stuff that melts into your skin—can reduce burn severity.

Two layers are better, of course, but good luck in getting people to believe that. A jacket is essential, and it should have lots of pockets to contain the matches and bug repellent that are so essential in the relatively short season of poor sledding that characterizes the months from June through October. One summer survivor stated, only semi-jokingly, that to him, the bug repellent was even more important than the matches.

After a crash, forced landing or other misadventure, the first thing to do, after tending to major first aid items such as stop the bleeding and start the breathing is to: *Notify SAR*. How do you do that? Turn the emergency locator transmitter (ELT) function switch to ON. Yes, the crash should have done that, but turn it on, and leave it on. Never turn it off. Let the SAR tech do that.

Now, let's say the ELT was destroyed in the crash. Now what? You, of course, filed a flight plan, didn't you? And, you didn't diverge from it, did you? If you fail to arrive at your destination, the fine folk at NAV CANADA will notice your still-open flight plan. They will notify SAR, who will dispatch a search aircraft to the ominously named LKP—or last known point—and the SAR or

Civil Air Search and Rescue Association (CASARA) aircraft will do a track crawl from there.

I can hear you now. "Oh heavens, that'll take forever. I'll just walk back to that little cluster of lights we passed about ten minutes ago." Unless you can clearly see the cluster of lights, and hear the drunks arguing in the bar, stay put! Small as it is, your aircraft is much easier for a spotter to see than you are, even if you are waving your arms at helicopter liftoff speeds. And, if your ELT did work, that's where the rescue bird will go.

Within recent memory, experienced woodsmen have indeed walked out from remote crash sites. Why not you? They had more than the usual amount of survival gear on board, they were dressed for winter camping, they were uninjured, they knew exactly where they were, and most important, they were, in every sense of the phrase, experienced woodsmen. Most of us are not, so if you do find yourself out in the woods, looking at a failed aircraft, stay with it unless a grizzly bear roars out of a nearby lake and forces you to move.

Getting you out of the woods quickly requires that SAR be notified quickly. Currently, your ELT looks after that. Starting in 2009, when the last satellite equipped with 121.5/243.0 MHz "ears" plunges into the sea, your ELT will no longer provide prompt alerting or position fixing. Yes, it will still attract the attention of search aircraft that are equipped with 121.5 MHz homers, but your existing ELT, unless it transmits on 406 MHz, will no longer notify SAR of your problem.

Thus, you will have to become more diligent in filing flight plans, notes or itineraries. And you will have to become more diligent in following them, a feat which your lovely little hand-held GPS makes easy to accomplish...until the batteries die. Some pilots have suggested that, after 2009, it might be a great idea to appoint a "trusted agent" who can be relied upon to phone air traffic services (ATS), the local police or even a rescue coordination centre (RCC) to say that, "Buzz Spiraldive was on a flight from Hitherto to Somewhere Junction and was expected here at 1745. He has not arrived, and is now overdue."

The more information the "trusted agent" can provide, the better, and they must—absolutely must—be armed with the correct phone number to call to get the SAR gears cranking. In slightly more than just 100 years, aviation has become a trusted means of transportation, but it's not risk-free. You have to manage the residual risk, and general aviation (GA) has more than its share of it. Preparing for a possible survival episode is a lot better than failing one. Δ



REGULATIONS AND YOU

The Tribunal Rules: Two Recent Decisions Handed Down by the Transportation Appeal Tribunal of Canada

In this issue, the Advisory and Appeals Division of the Regulatory Services Branch, thought to share two decisions that were handed down by the Transportation Appeal Tribunal of Canada (TATC) in the last year. These decisions are of particular interest to pilots because, in one case, the Tribunal studied the definition of an ultralight airplane, and in the other, it reviewed in detail the notion of an approach in view of landing. The names of the people involved have been changed, because the goal of this article, and our newsletter, is simply to share lessons learned.

Let's first look at the case *Tremblay v. Minister of Transport*.

Some charges were laid against Mr. Tremblay because he had acted as, among other things, a pilot-in-command of an aircraft without holding a permit or licence for the duties he performed. In fact, Mr. Tremblay held a pilot licence—ultralight airplane, and was flying a Cessna 150G that he owned.

In his defence, Mr. Tremblay claimed that his aircraft was an ultralight, given the modifications that he made. In his opinion, he therefore had the appropriate licence. The modifications made to the Cessna made it so that the weight empty was 975 lbs.

However, the Tribunal did not accept Mr. Tremblay's argument. It concluded that, despite the modifications made to the aircraft to make it lighter, the Cessna 150G is designed and constructed to have a maximum weight of 1 600 lbs and a stall speed of 41.6 kt, which does not comply with the requirements of an ultralight. Indeed, the *Canadian Aviation Regulations* (CARs) prescribe that an ultralight airplane have a maximum take-off weight of 544 kg (1 200 lbs) at the most, and a stall speed in the landing configuration of 39 kt. In addition, the Tribunal pointed out that an aircraft could not belong to more than one category, class or type.

Another interesting decision is the one handed down in the case *Roy v. Minister of Transport*.

In this case, Mr. Roy had been accused of using a helicopter at an altitude below 1 000 ft, over a built-up area. During the review hearing, Mr. Roy admitted to having indeed flown at a low altitude over a built-up area, but claimed that he had proceeded on an approach in view of landing. He testified that he was looking for a service station; a landmark that had been given to him for landing.

Although an approach in view of landing is an exception to the rule that prohibits a pilot from flying at low altitude, the Tribunal considered that, given the circumstances, the exception could not apply. Indeed, the Tribunal stated that, "An approach is not a tool to be used for searching for a proposed landing site. Searching for a landing site and conducting an approach are two different procedures. I am of the view that an 'approach' is a distinct manoeuvre. An approach cannot be started until the landing site has been identified. It is a process used to land an aircraft once the actual landing site has been determined after the search for the landing site has been completed. The approach is the descent from altitude immediately preceding a landing and in my view limited to that purpose. While it varies with circumstances of each case, it does not require an inordinate length of time or, in the case of a helicopter, an inordinate distance." [Translation]

The Tribunal added that an approach could not take an unlimited amount of time or space. It must rather be a definite and deliberate process, with a specific goal. The Tribunal's counsel clearly stated that an approach could not be used as an excuse to maintain flying at a low altitude. In his opinion, the approach procedure would be limited to a distance from the landing site that is reasonable, and does not pose a risk to conducting the approach.

In this particular case, the Tribunal ruled that the appropriate landing procedure was the one applicable to restricted areas. This required, first, a flight at least 1 000 ft above surface obstructions to the location of the service station being sought; the landing procedure could then be initiated. The counsel concluded that the maximum length of the approach that should have been conducted for landing was ½ mi.

We hope that these examples have given you a better understanding of the definition of an ultralight airplane, and the idea of an approach. Happy flying! Δ

DEBRIEF

Fuel Tank Selector Reminder

On March 19, 2006, an amphibious Cessna A185F lost all engine power shortly after takeoff. The pilot was able to land on the remaining runway, but the landing gear could not extend fully, causing minor damage to the keel strips. Prior to starting the engine, the pilot rotated the fuel tank selector into what appeared to be the BOTH position. After starting, the engine was operated at idle until the oil warmed up to 75° before a run-up check was performed. The aircraft was then taxied a short distance to the runway for takeoff. When the engine lost power, it had been running for 10 to 12 min. It was determined that the fuel tank selector was in an unmarked OFF position; 180° opposite the BOTH position. This aircraft fuel system includes two main tanks—one in each wing—that feed through a fuel tank selector valve to an accumulator tank mounted on the firewall, thence through a fuel shut-off valve into the engine compartment. The fuel tank selector valve is located on the cabin floor between the front seats. There is a vapour return line that returns vapour and excess fuel from the engine-driven fuel pump to the accumulator tank.

The valve is described in the pilot operating handbook (POH) as a “three-position selector valve labelled LEFT TANK, RIGHT TANK, and BOTH ON.” When not installed, the valve can be rotated to a fourth position, OFF, that is 180° opposite the BOTH position. The valve has detents that have the same tactile feel in all four positions. However, when installed, it is constrained from being selected to the OFF position by a plastic ridge around the fuel tank selector cover, as shown in Figure 1. This plastic ridge can be stepped on by passengers and damaged. If this happens, the fuel tank selector valve can be accidentally rotated to the OFF position.



Figure 1. Fuel tank selector cover prevents selection of the undocumented OFF position



Figure 2. Damaged fuel tank selector cover—fuel selector in undocumented OFF position

As seen in Figure 2, the ridge on the plastic cover was damaged, allowing the selector valve to be rotated to the OFF position. The valve was also partially obscured by the water rudder handle, so the pilot relied on feel to determine the switch position, and the incorrect position of the valve was undetected. The fuel in the accumulator tank (approximately ½ gal.) was sufficient to allow the pilot to start the engine, taxi, carry out run-up and before-takeoff checks, and take off, before it was exhausted, shortly after the aircraft became airborne.

There may be a belief that if a fuel selector is in the OFF position, there is insufficient fuel in the lines to start the engine, taxi, carry out run-up and before-takeoff checks, and take off. The accumulator tank in the Cessna 185 contains approximately ½ gal. of fuel. In the event that the valve is OFF and no fuel flows to the accumulator tank, the vapour return line acts as a vent, allowing the fuel in the accumulator tank to be consumed before the engine is starved.

Therefore, keep in mind that in the event of an improper fuel tank selection, there may be sufficient fuel downstream of the selector valve to allow the aircraft to take off before fuel exhaustion occurs. Also, always check the position visually, not by feel. Δ



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Counting the Accidents
You Don't Have...

Evaluating safety
performance in a
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Measuring safety is all too often reduced to counting accidents. However, accidents are rare, so this only tells a small part of the story; the whole story is more complex.

Linking safety performance to outcome measures, such as accident statistics, leads to a *reactive*, rather than *proactive*, approach.

Safety is about managing risk. But how do you know how well you manage your risks? How do you evaluate how well your management system is working? How do you know if your company's practices are consistent across, and throughout, your organization? If we are to manage safety, we must learn other ways of assessing and evaluating the ultimate results of our safety management efforts.

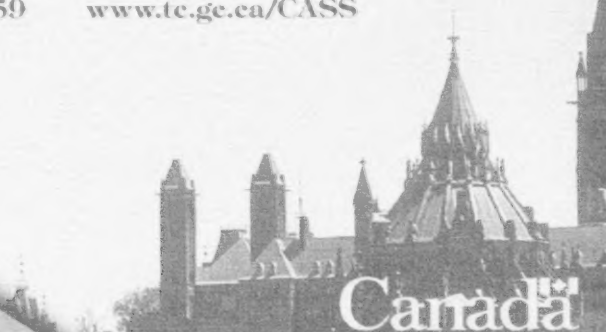
As we move forward with the implementation of safety management systems (SMS) to proactively manage risk, we cannot underestimate the importance of continually evaluating safety performance. Through a series of interactive workshops and a plenary session, CASS 2007 will explore how to evaluate safety performance, including, but not limited to, risk, human and organizational factors, system effectiveness, and safety culture. Our goal is to further our understanding of this necessary aspect of safety management, and look at how to apply this in a real-world setting.

Call For Papers

We invite you to submit abstracts for plenary presentations and workshops for CASS 2007. Abstracts will be accepted until **September 22, 2006**, and are to be a maximum of 200 words. They are to be accompanied by the presenter's curriculum vitae and must be submitted by e-mail to ssinfo@tc.gc.ca as a text document attachment, or via the online form at www.tc.gc.ca/CASS.

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